Electrical World

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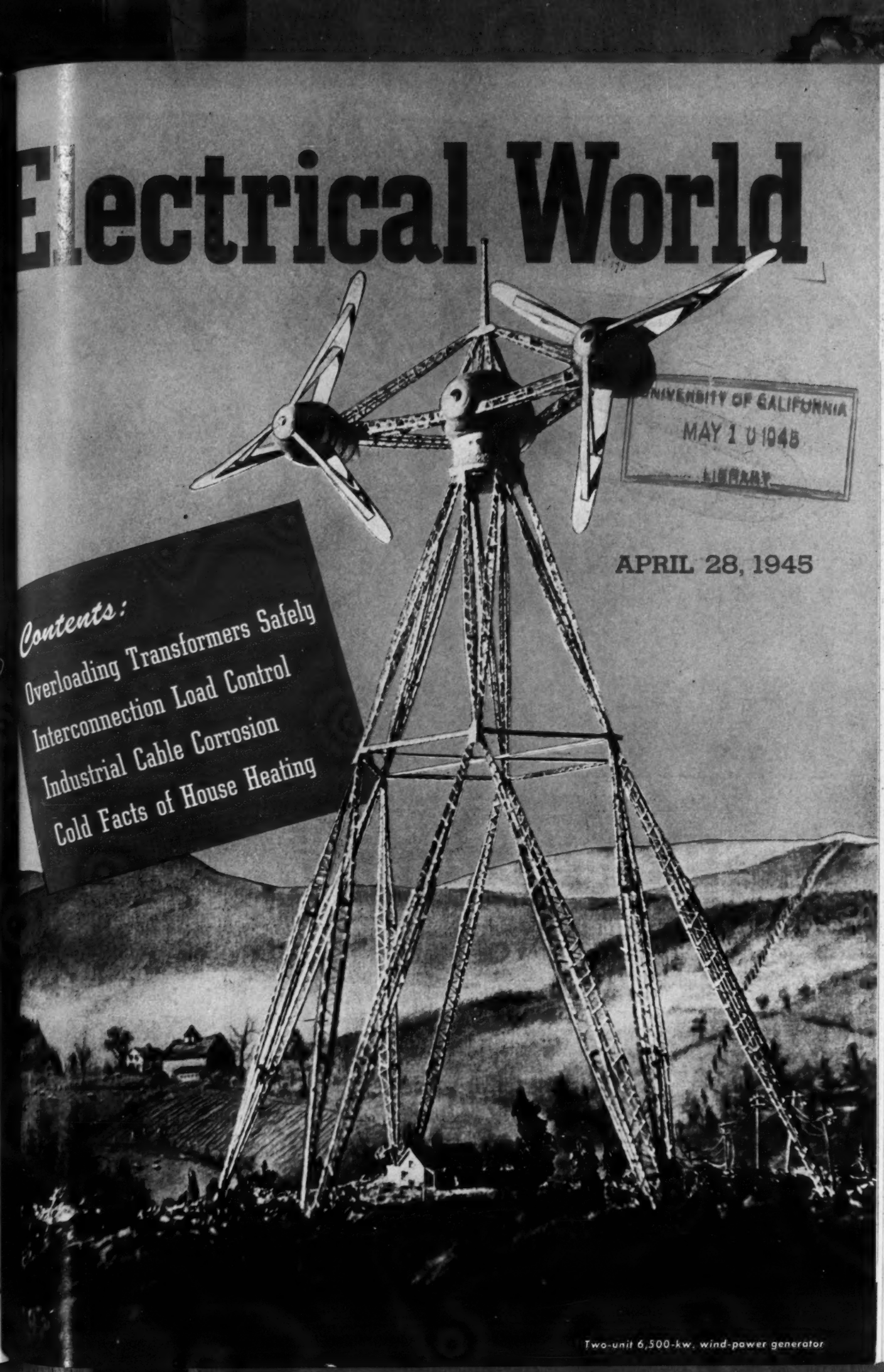
Overloading Transformers Safely
Interconnection Load Control
Industrial Cable Corrosion
Cold Facts of House Heating



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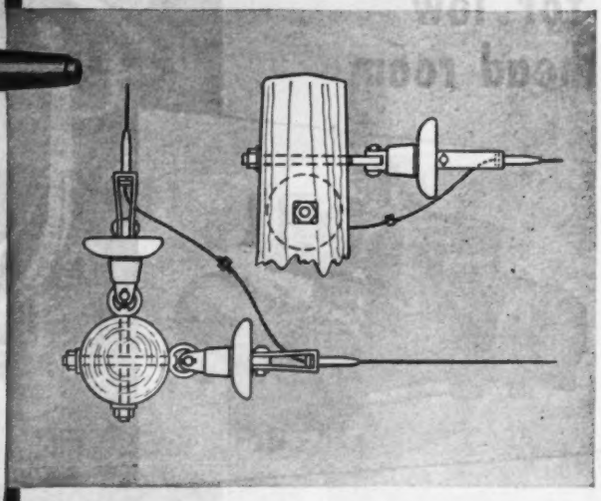

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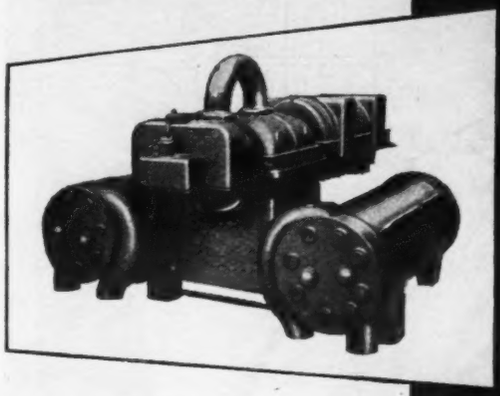

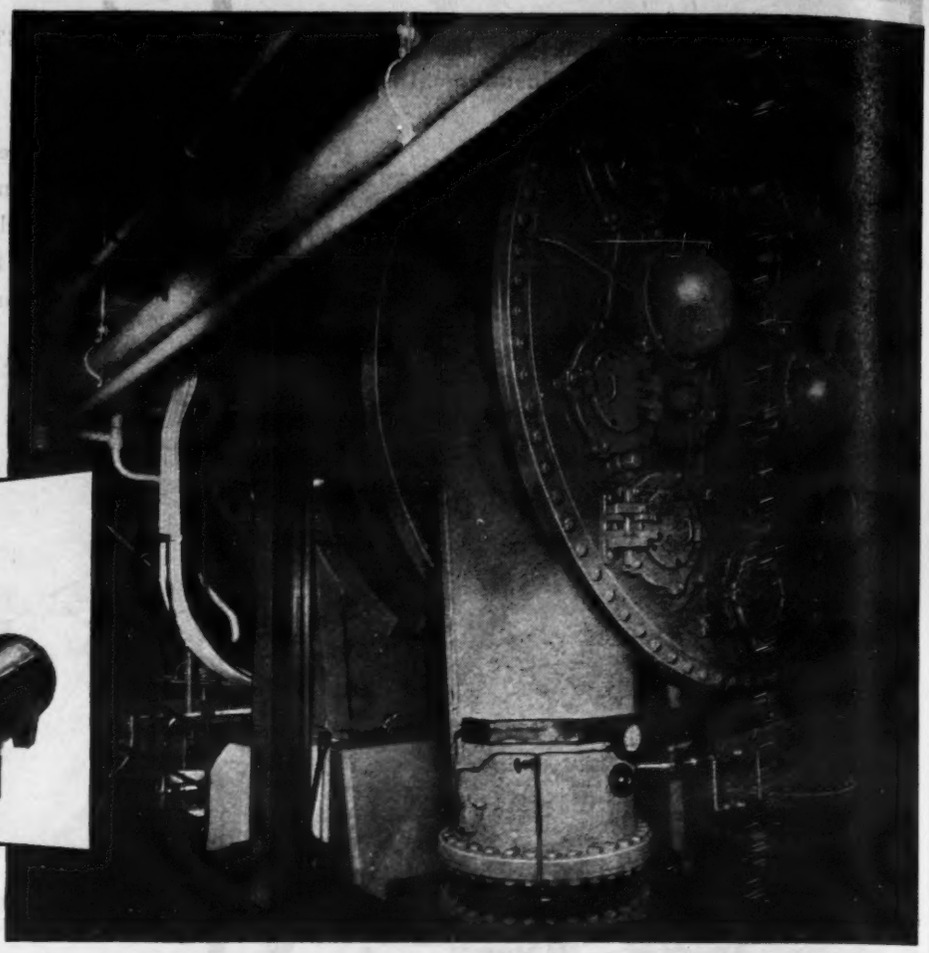

How an unusual condition was met with CONDENSERS by ELLIOTT

The photograph shows one side of a twin 60,000-sq. ft. Elliott condenser which serves a 65,000-kw turbine-generator, first unit in the new Harbor Steam Plant of the City of Los Angeles. The picture of the model which was made for study before the plant was built shows the arrangement of the turbine-generator with the twin condensers on either side, the units being joined by a special exhaust connecting piece. The twin arrangement of the condenser was desirable for several reasons, one of which was rigidity and low center of gravity, vital in designing the turbine foundations to withstand possible earthquake tremors.

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C-384

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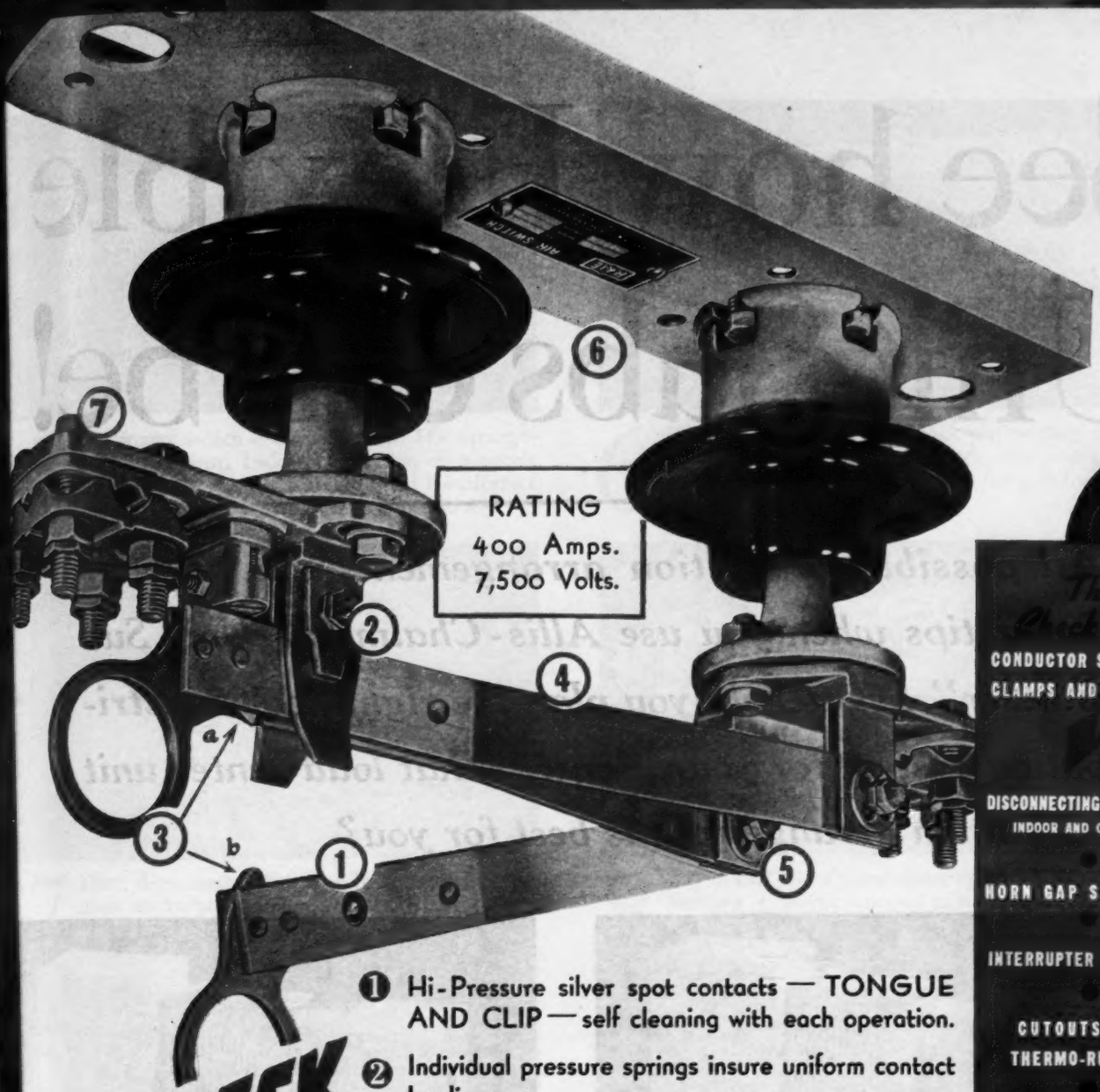

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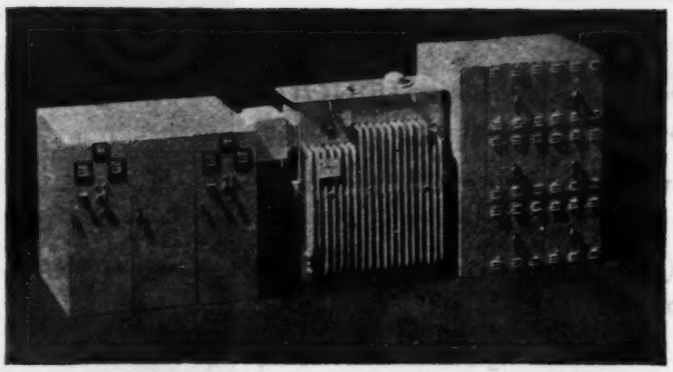
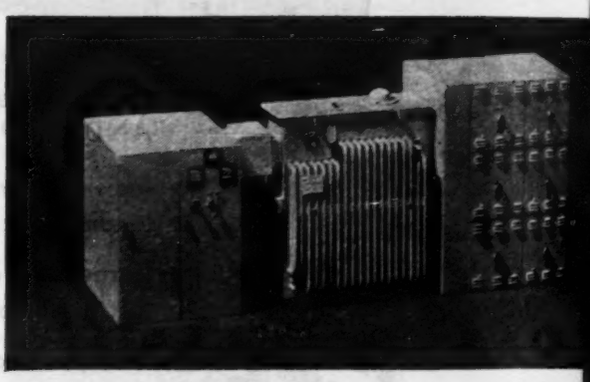
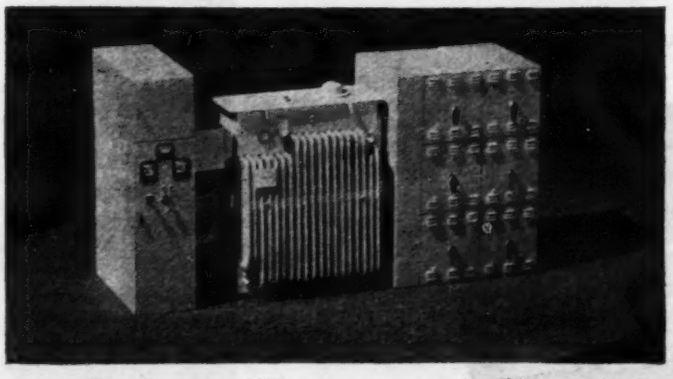


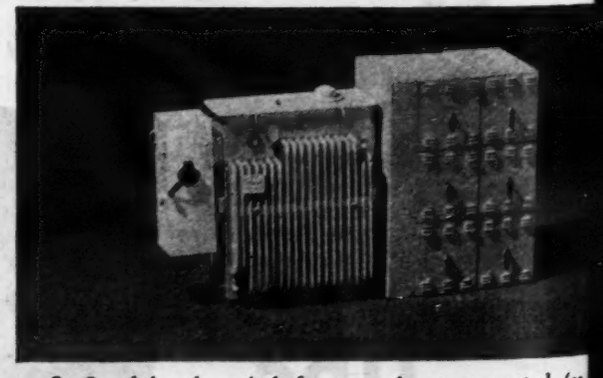
1 High voltage switchgear arranged for two incoming lines, liquid-filled transformer, simplest possible low voltage unit assure extremely dependable power supply. Primary breakers operate electrically.



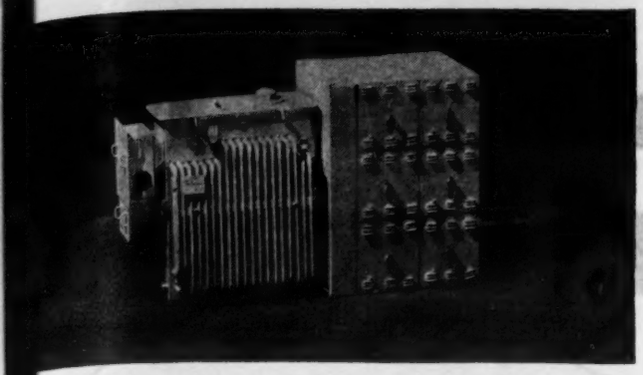
2 One incoming line. As in set up 1, equipment can have almost any primary metering, relaying. However, breaker may be manually operated and only potential transformers required as in . . .



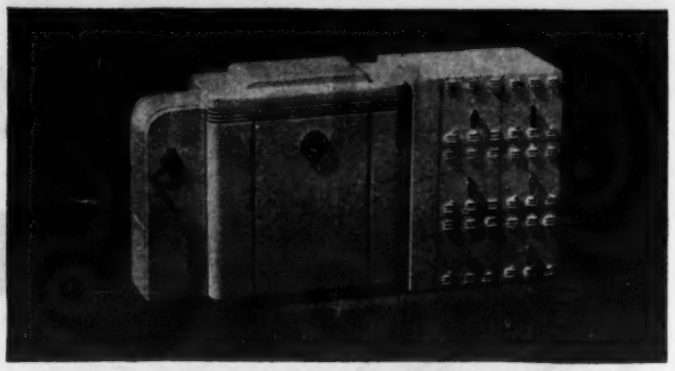
3 Common HV arrangement. Auxiliary compartment is not required. A set of potential transformers is mounted in a superstructure which can be removed if transformers are not needed.



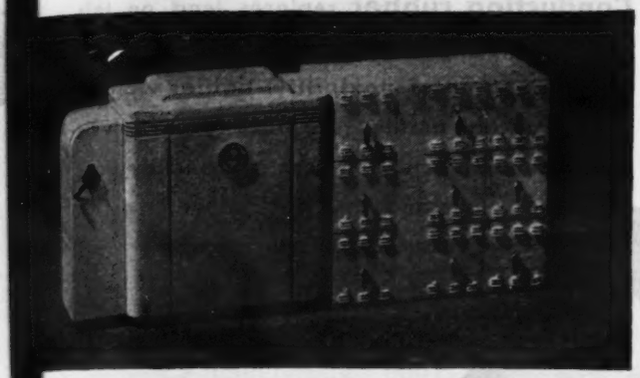
4 Load break switch-fuse — throat-connected (as here) or mounted directly on the transformer — replaces breaker. Where only disconnect switch is used, the substation would appear as set up 5.



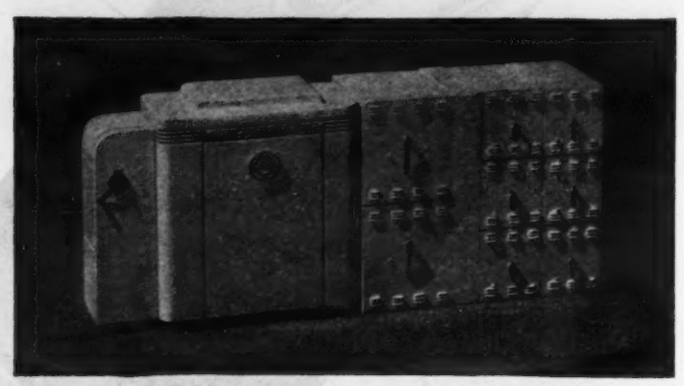
5 Disconnect switch is most common HV arrangement. Requiring back-up protection of a circuit breaker, it is used with liquid-filled transformer (above) . . . or dry-type (next illustration).



6 If disconnect switch will break magnetizing current only, it requires an interlock. Simplest and most positive is a key interlock to the transformer secondary breaker, as in photo 7.



7 Here, disconnect switch may be interlocked with main secondary breaker. However, all current from the transformer must flow through this breaker — requiring a larger breaker as in . . .



8 A 750 kva, 240 v transformer needs 50,000 amp breakers if direct-connected to transformer. Main breaker, when used (photos 8, 9) must carry 1800 amps, be rated 75,000 amps.

9 Same transformer . . . using cascaded 75,000 amp main breaker, 25,000 amp feeder breakers. Main breaker can handle maximum short circuit of 48,000 amps. All feeders lose load when one faults.

10 To see how Allis-Chalmers "Unit Sub Builder" Set can help you, call your nearby A-C district office for a showing. No obligation, of course. ALLIS-CHALMERS, MILWAUKEE 1, WIS.

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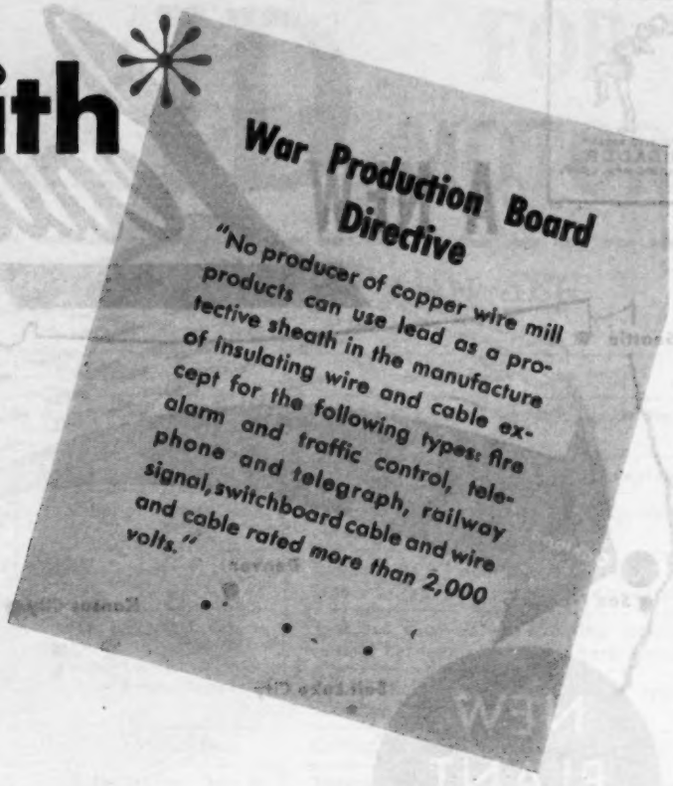
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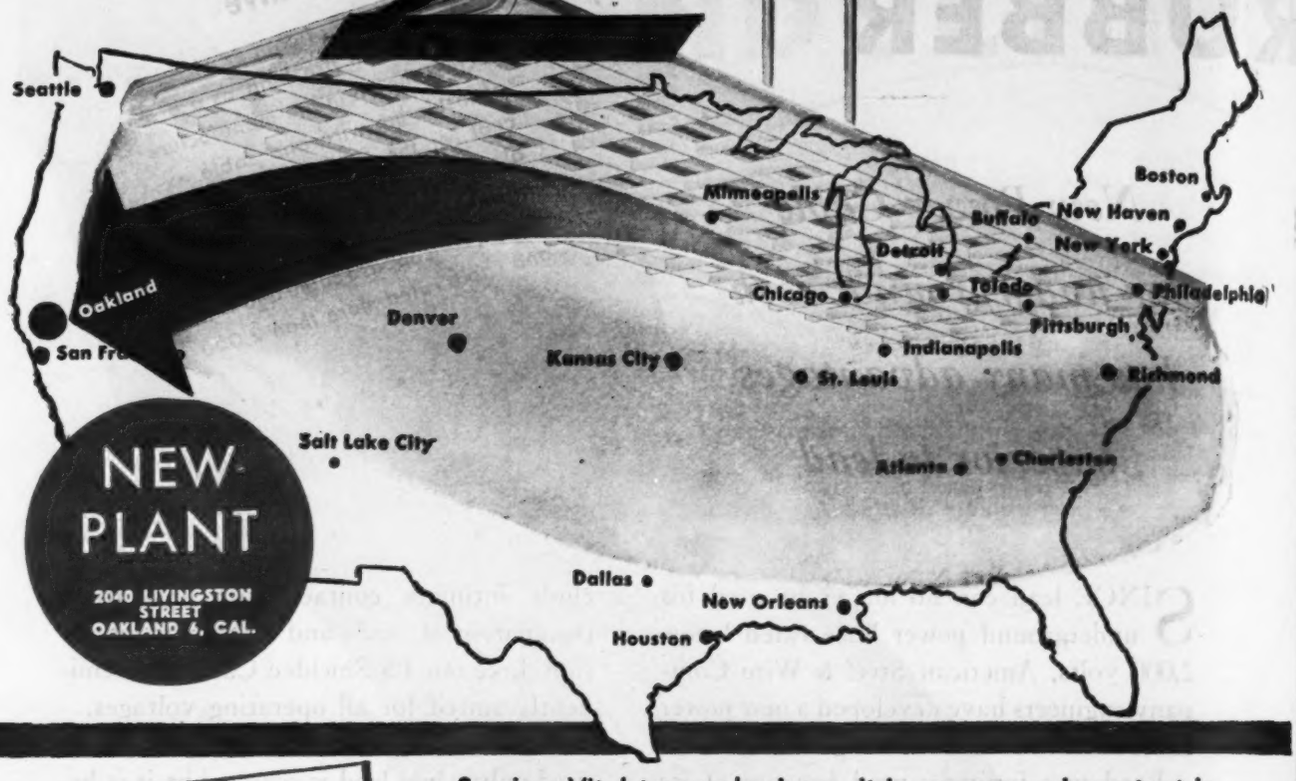

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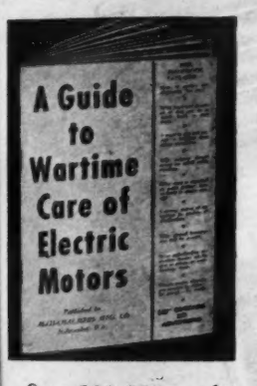

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SYMPTOMS YOU CAN SEE

Symptom	Possible Causes	Cure
1. Excessive sparking or flashing at brushes. Blackened commutator.	Rough commutator.	Sand or turn down, depending upon depth of surface roughness.
	Low bar on commutator.	Grind or turn down balance of commutator.
	High bar on commutator.	If extreme, lower with mallet, tightening clamping ring. Grind true.
	Brushes too short.	Replace with harder grade—if worn too soon . . . and not by rough commutator.
	Shorted armature winding.	Test for short—after removing metallic contact between commutator bars. Repair.
2. Intermittent sparking at brushes.	Open armature winding.	Locate and replace bad coil—or repair defective joint.
3. Motor won't start.	Usually line trouble.	Correct. Check source of power supply.
	Load too heavy. See if motor runs without load.	Reduce load—or replace motor with unit of greater capacity.

SYMPTOMS YOU CAN HEAR

4. Excessive hum.	Uneven air gap. Measure with feelers.	Replace bearings—before introduction of scraping noise indicates rotor is rubbing.
	Unbalanced rotor. Check on parallel bars.	Balance with solder on band—or weight attached by cap screw and lock washer.
5. Regular clicking.	Matter in air gap.	Take out rotor; remove matter.
6. Rapid knocking	Misalignment.	Realign set until knocking disappears.
7. Brush "chatter."	Extreme vibration.	See item 10, below.

SYMPTOMS YOU CAN FEEL

8. Vibration.	Misalignment.	Realign set.
	Vibration in driven machine.	Eliminate source in machine, if possible. Or a flexible belt drive may be in order.
9. Motor overheating. (Check with thermometer—don't depend on hand).	Overload. Measure load; compare with nameplate rating.	Check for excessive friction in motor, drive or machine. Reduce load, or replace motor with greater capacity unit.
	Dirt in motor. Check flow of air.	Blow out motor. Use solvent on wound section if necessary.
	Rotor rubs stator.	Replace bearings.

A 1638

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When you do need new motors, look into the strength, solidity and all-around protection of the new "Safety Circle"—protected top, sides, ends and bottom.

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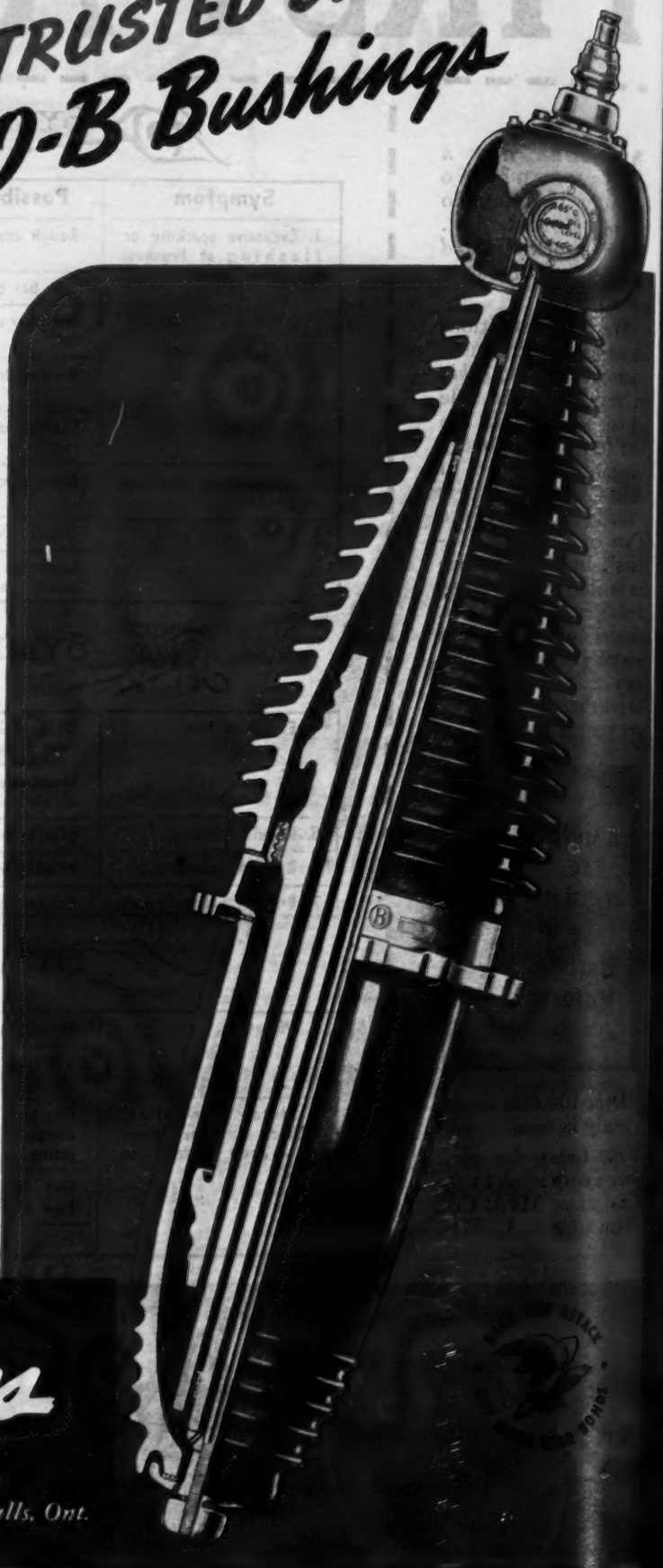

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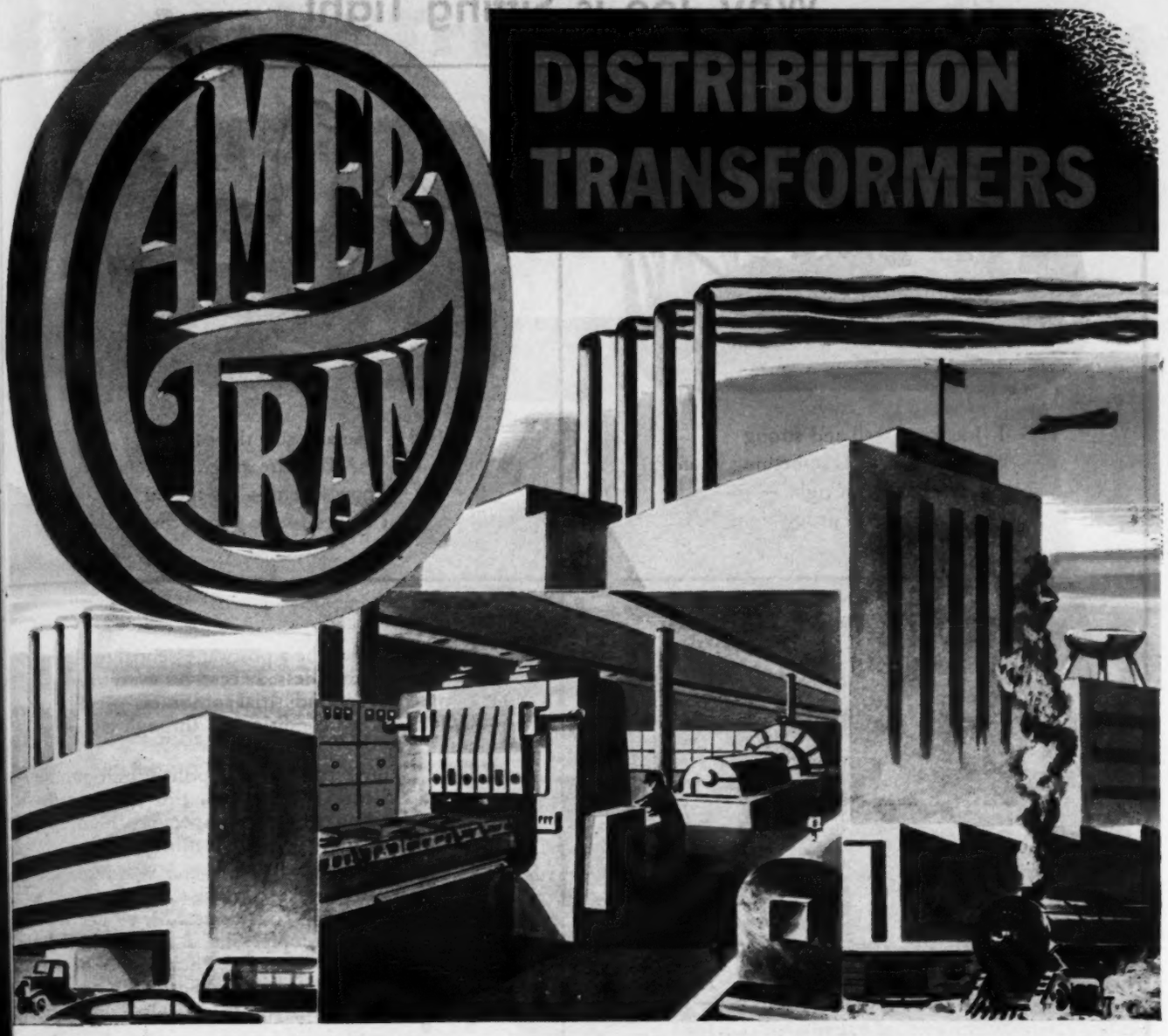


For Postwar Industrial Applications

Postwar competition will be so keen that all industries must watch costs more closely than ever before. In power distribution, particularly, direct and indirect economies will be sought. Anticipating this trend, the new AmerTran Distribution Transformers are designed to provide more value per dollar. They represent the ultimate in long trouble-free life and high efficiency.

With minimum installation, operation and maintenance costs, AmerTran Distribution Transformers embody the quality workmanship, ruggedness and precision that have distinguished AmerTran products for more than 40 years.

LOOK FOR THESE ADVANTAGES IN THE COMING AMERTRAN DISTRIBUTION TRANSFORMERS

LOWER EXCITING CURRENT
SMALLER SIZE LIGHTER WEIGHT
INCREASED OVERLOAD CAPACITY
IMPROVED TANK CONSTRUCTION
COORDINATED INSULATION
IMPROVED REGULATION
NEW TERMINAL FACILITIES

AMERTRAN

MANUFACTURING SINCE 1901 AT NEWARK, N. J.

Pioneer Manufacturers of Transformers, Reactors and Rectifiers for Electronics and Power Transmission

THE AMERICAN TRANSFORMER COMPANY, 178 Emmet St., Newark 5, N. J.

Why Joe is Sitting Tight

1 G. I. Joe, now well and strong
Won't get up — Is something wrong?
No, it's certain all is right —
That's why Joe is sitting tight.

2 Bed is fine and so's the cooking.
Nurses? They are all good-looking.
But — now listen — it's the air
That makes Joe so happy there.

3 He feels calm, cool and collected
In air thoroughly corrected.
(Seems a shame to make him go —
Westinghouse has spoiled our Joe.)

Air Conditioning will be a postwar essential to almost every conceivable business. Executives everywhere — your commercial and industrial consumers — are hearing about *correct* air conditioning through advertisements like this.

They're learning to depend upon Westinghouse for correct air conditioning . . . the scientifically-engineered blending of correct temperature, humidity, circulation, ventilation and air cleanliness.

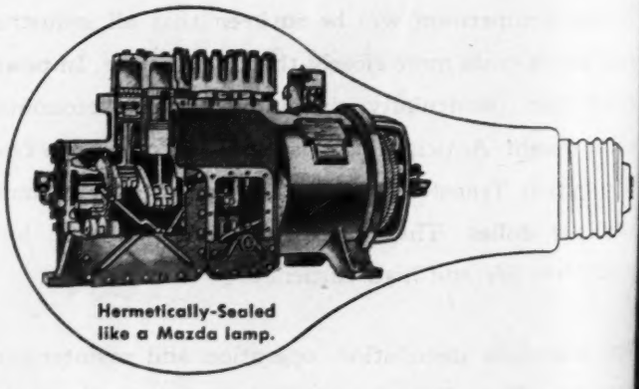
Your commercial men will find the Westinghouse booklet "How to Plan Correct Air Conditioning," a valuable aid in showing consumers how to get what they need for their complete satisfaction. We'll be glad to supply it in quantity. Phone your nearest Westinghouse office or write Westinghouse, 150 Pacific Avenue, Jersey City 4, N. J.

THE SERVICE-PROVED HERMETICALLY-SEALED COMPRESSOR

These Westinghouse economy-satisfaction advantages have been proved by years of service in thousands of installations:—

No Shaft Seals. **During wartime refrigerant shortages, few Westinghouse systems were ever "down." Why? Because seal leaks are the cause of a large percentage of all system failures.**

Few Parts to Wear . . . Direct-Drive Efficiency . . . Space-Saving Refrigerant-Cooled Motor.



Hermetically-Sealed like a Mazda lamp.

Westinghouse Air Conditioning

PLANTS IN 25 CITIES . . OFFICES EVERYWHERE

Westinghouse Presents *John Charles Thomas* • Sunday, 2:30 E.W.T., N.B.C.

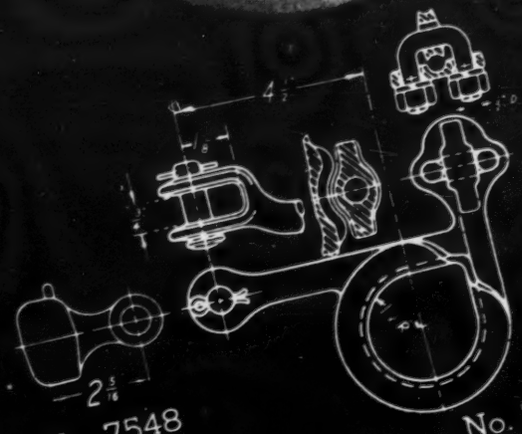
For Light Transmission Lines

Specify

Drop Forged Clamps

Designed for dead-ending the lighter duty transmission and distribution lines — hundreds of thousands of these familiar and accepted snubbing type clamps are in use in all parts of this and other countries — and for good reasons . . .

- Forged steel gives a light-weight clamp of adequate strength.
- A short connection length protects the conductor against vibration effect.
- Ample radius of snub, smooth cable seat and long clamping keeper prevent damage to the conductor.
- Side opening type is easy to install and work with hot line tools.
- Reversible two-groove keepers accommodates a wide range of conductor sizes.
- For full detail, write — Engr. Dept. C.F. Div.



No. 7548 No. 7511

No. 7511 (without fitting). No. 7548 (with socket eye). For all conductors within its size range. Min. 0.16 — Max. 0.55.
Not recommended for A.C.S.R. conductors larger than No. 2-0 due to their stiffness.
Ultimate strength 10,000 lbs. Shpg. wgt. 280 lbs. per C.

Through Your Insulator Manufacturer Only

B-C

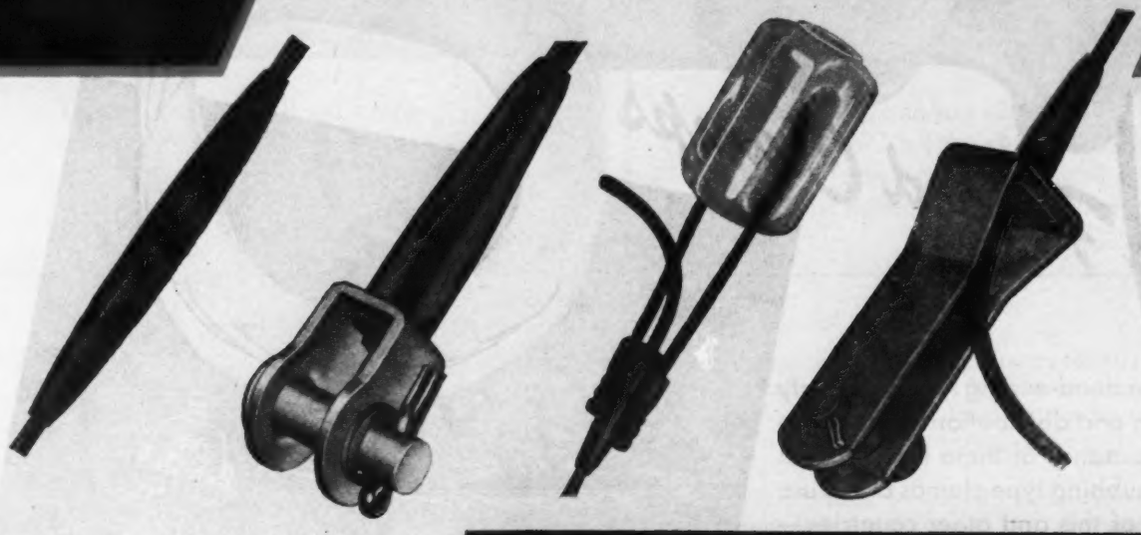
Transmission Line Hardware

THE BREWER-TITCHENER CORPORATION
CORTLAND, NEW YORK

4TH TEST OF A SERIES

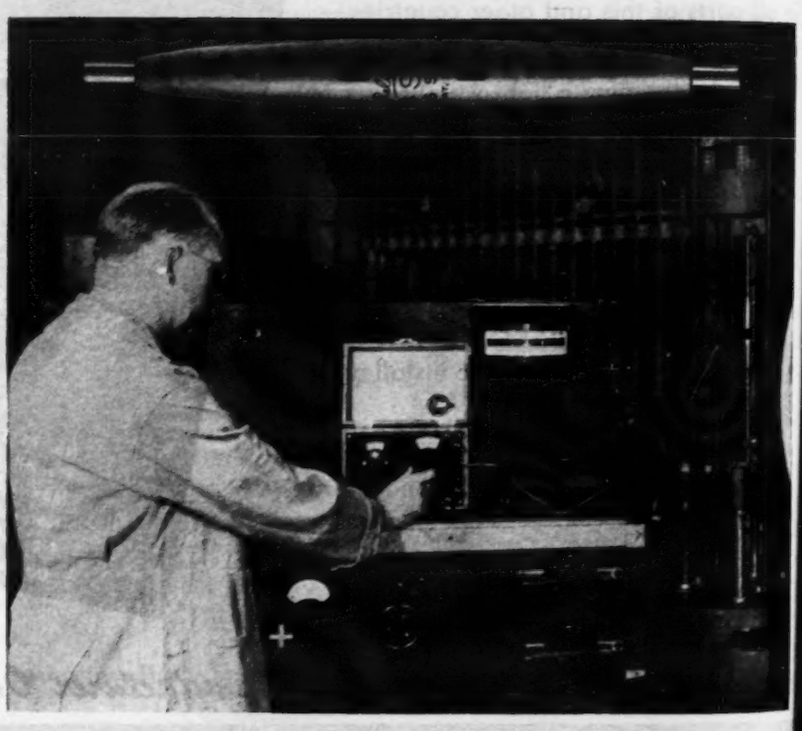
Reliable proves STRAIGHTLINE SPLICES AND DEAD ENDS

HIGH IN CONDUCTIVITY



Load tests, that range from summer span to full line strength, consistently show Reliable Connectors, Splices and Dead Ends to have better conductivity than an equal length of the line wire. Here again precise quality control establishes and maintains Reliable uniformity.

1. Gripping Test
2. Vibration Test
3. Corrosion Test
4. Conductivity Test

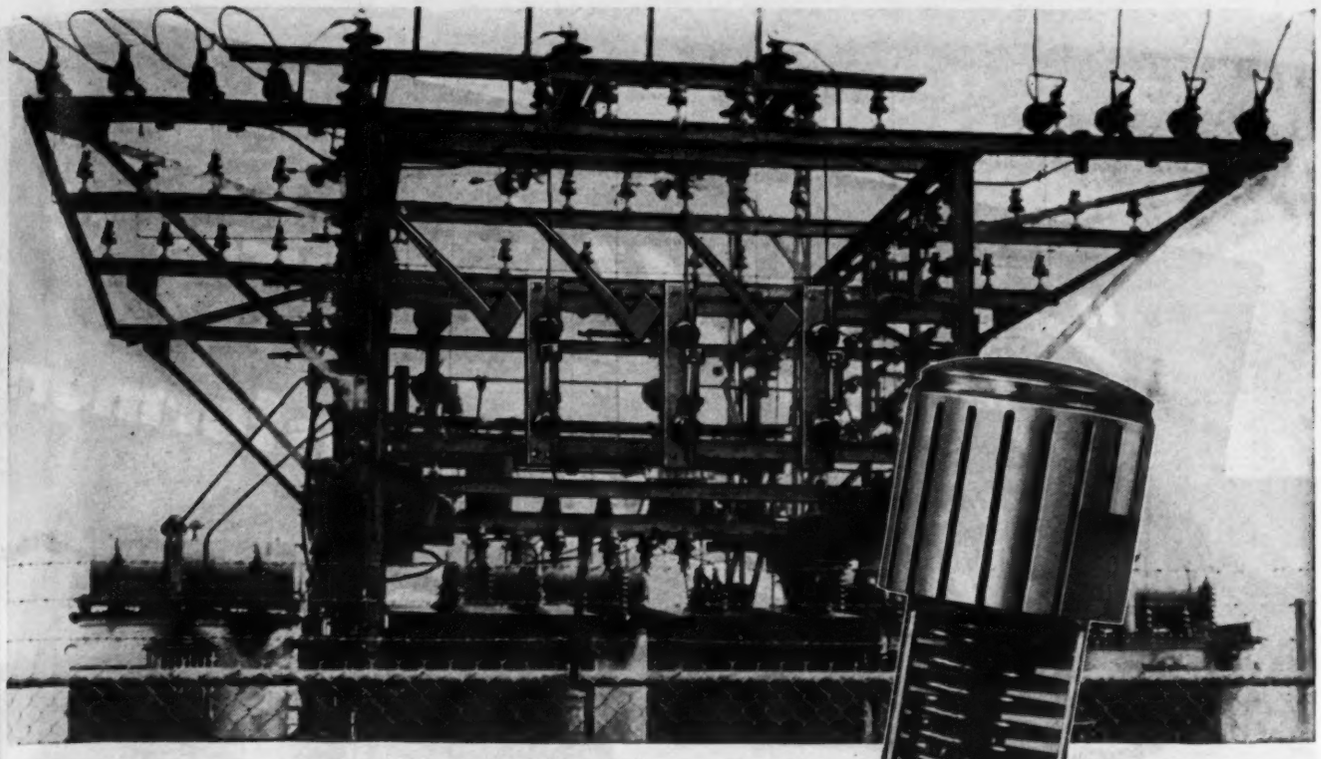


An actual test of conductivity under varying tensions being conducted on a Reliable STRAIGHTLINE SPLICE.

RELIABLE ELECTRIC COMPANY

3145 Carroll Avenue, Chicago 12, Ill.

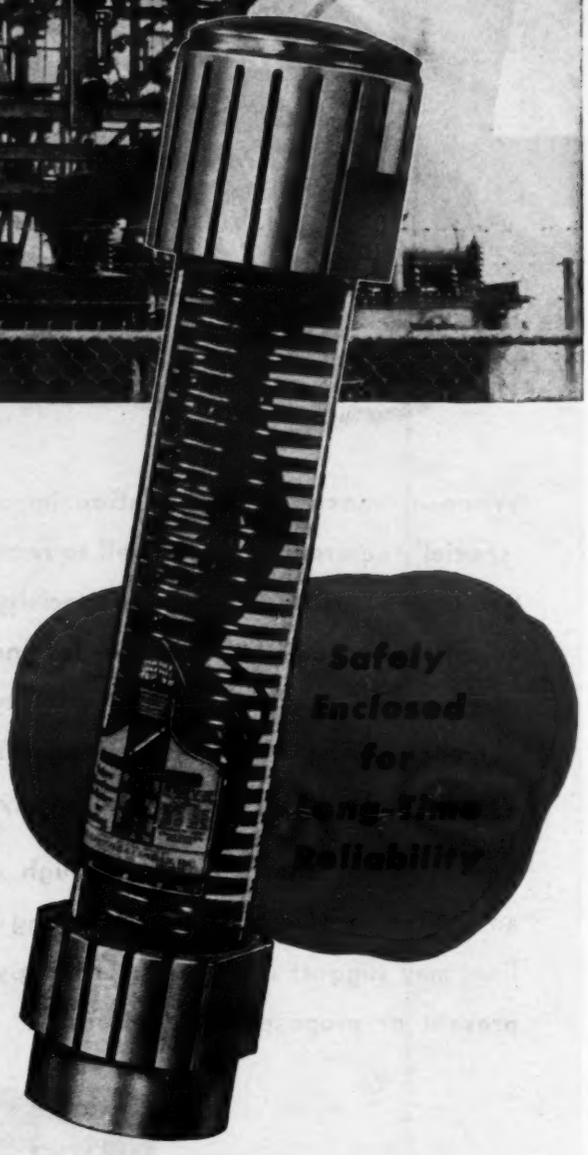
OVER 35 YEARS' SERVICE TO THE UTILITIES



Still The Preferred Power Fuse—1944 Installations Again Exceeded Previous Year

Records for 1944 reveal continued increases in installations of S & C Liquid Fuses.

Discriminating engineers of our important power companies are well aware of the many years of reliable, economical protection provided by these Fuses of high current interrupting ratings. These men recognize the value of accuracy of time current characteristics—the non-corrosive character of the pure silver fusible elements,—the fast clearing of fault currents,—and the ease of inspection from the ground. Send for Bulletin 200-B.



Liquid FUSES

¼ to 400 Amps., 7500 to 138,000 Volts.

SCHWEITZER & CONRAD, Inc.
4421 Ravenswood Avenue, Chicago 40, U. S. A.
Represented in Principal Cities (Consult Telephone Directory)
In Canada by Powerlite Devices, Ltd., Toronto, Ont.

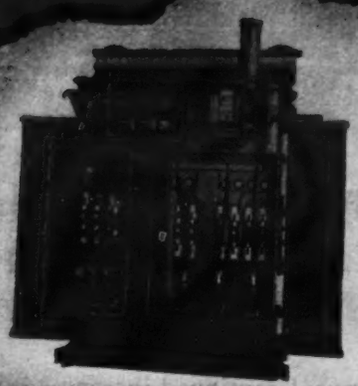
"EXPERIENCE WILL CHOOSE AN S&C FUSE"

"SPECIAL" features of Standard transformers

TRADE MARK

When a transformer installation imposes "special" requirements, it is well to remember that STANDARD makes a specialty of adjusting and adapting regular designs to meet special conditions. The flexibility of our engineering and manufacturing set-up permits us to do this easily and quickly.

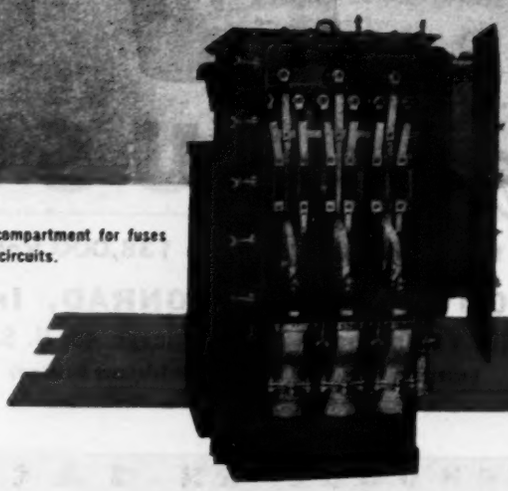
The examples shown here, although only an indication of our experience along this line, may suggest means of improving your present or proposed installations.



1500 KVA unit substation with meters, relays and low voltage fuses included.

Dry type transformer with fans for automatic accelerated cooling.

Two secondary transformer with terminal chamber including current transformers and pot heads for one end throat on other.



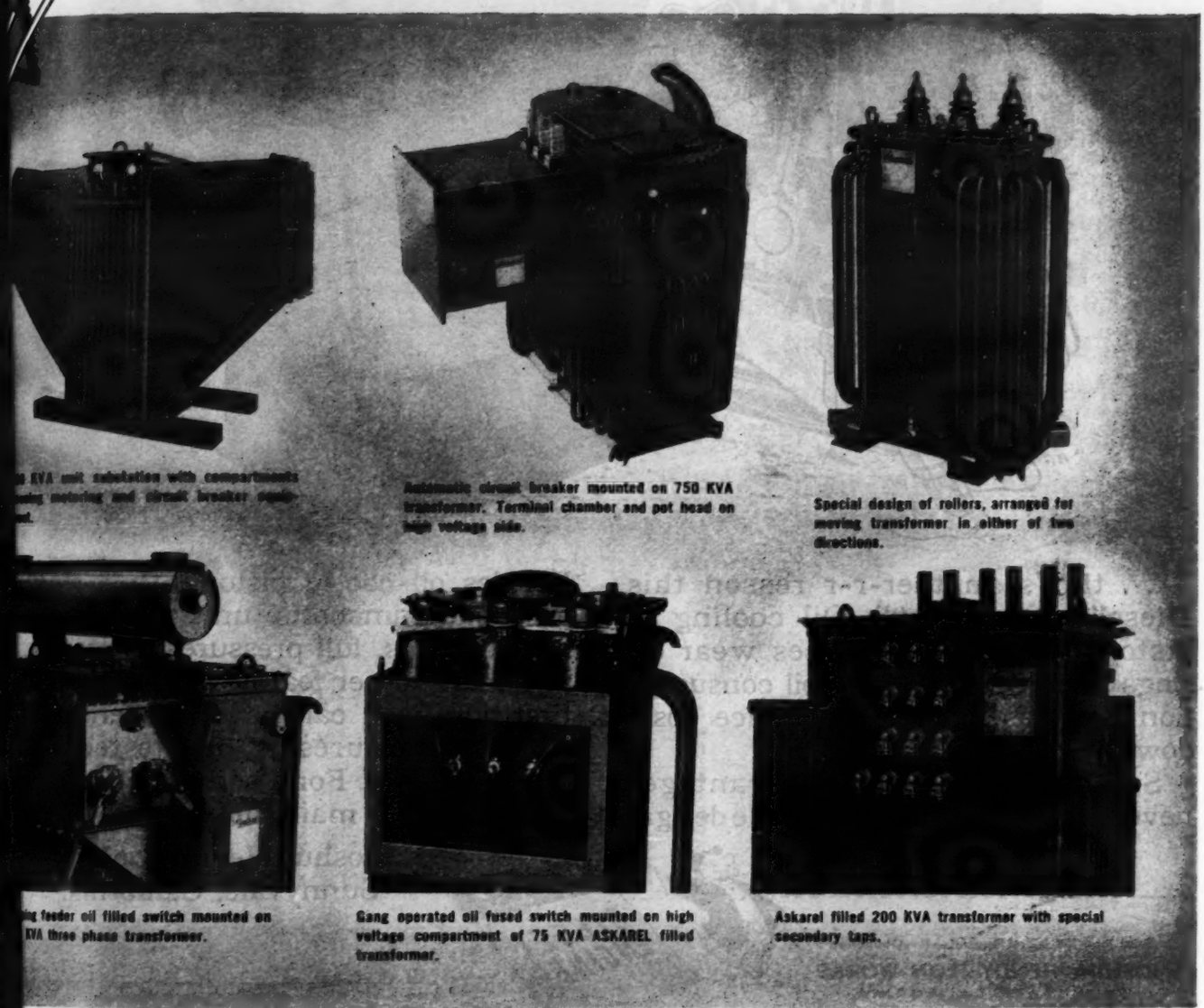
Weather proof compartment for fuses on low voltage circuits.

THE STANDARD

Makers of Transformers for : Distribution

WARREN, OHIO

are designed to meet your "SPECIAL" conditions



...KVA unit substation with compartments ...metering and circuit breaker equip...

Automatic circuit breaker mounted on 750 KVA transformer. Terminal chamber and pot head on high voltage side.

Special design of rollers, arranged for moving transformer in either of two directions.

...ing feeder oil filled switch mounted on ...KVA three phase transformer.

Gang operated oil fused switch mounted on high voltage compartment of 75 KVA ASKAREL filled transformer.

Askarel filled 200 KVA transformer with special secondary taps.

RANSFORMER • COMPANY

...er...Metering...Street Lighting...Testing...Dry and Liquid Filled Types

Offices in Principal Cities

"They'r-re richt, McDuffie, it HAS oil-cooled pistons!"

". . . thot's another-r-r reason this Diesel's sa thrifty." Oil cooling of pistons, McDuffie, reduces wear on rings and liners... lowers oil consumption . . . helps keep maintenance costs down.

Series 50 Diesels have advantages never before combined in a single design.

Besides oil-cooled pistons, they have overhead camshafts, unit pumps and fuel injectors, full pressure lubrication, and many other features. Now, for the first time, you can have the benefit of *all* these features in *one* tested and reliable Diesel. For a complete description, clip and mail the coupon today.

Joshua Hendy Iron Works,
Sunnyvale, California.

Send for NEW Diesel Booklet—No Obligation

JOSHUA HENDY IRON WORKS
SUNNYVALE, CALIFORNIA

Mail me your new booklet that completely describes the Series 50 Diesel, with photographs and cross-section cutaway drawings showing the design of all parts.

Name_____ Position_____

Company or business_____

Address_____

I am interested in Marine ☐ Stationary ☐ models and in hp ranges from 190-250 ☐ from 250 up ☐

69-D-16

G & W POTHEADS

SOLVE YOUR CABLE TERMINATING PROBLEMS

WEBSTER—Pothead (pot-hed) n. Elec.—A form of terminal hermetically sealed to the sheath of an electric cable for making a moisture-proof connection between the wires within the cable and those outside.

G & W POTHEADS more than meet Webster's definition of potheads. They more than provide positive, hermetic sealing against entrance of moisture. They also prevent leakage of compound or cable-impregnating oil. Not just in fair weather and while they're new—but in all weathers and for years upon years. That is the definition of G & W POTHEAD value and service. It is also why so many representative utility companies define G & W as the potheads upon which they standardize.

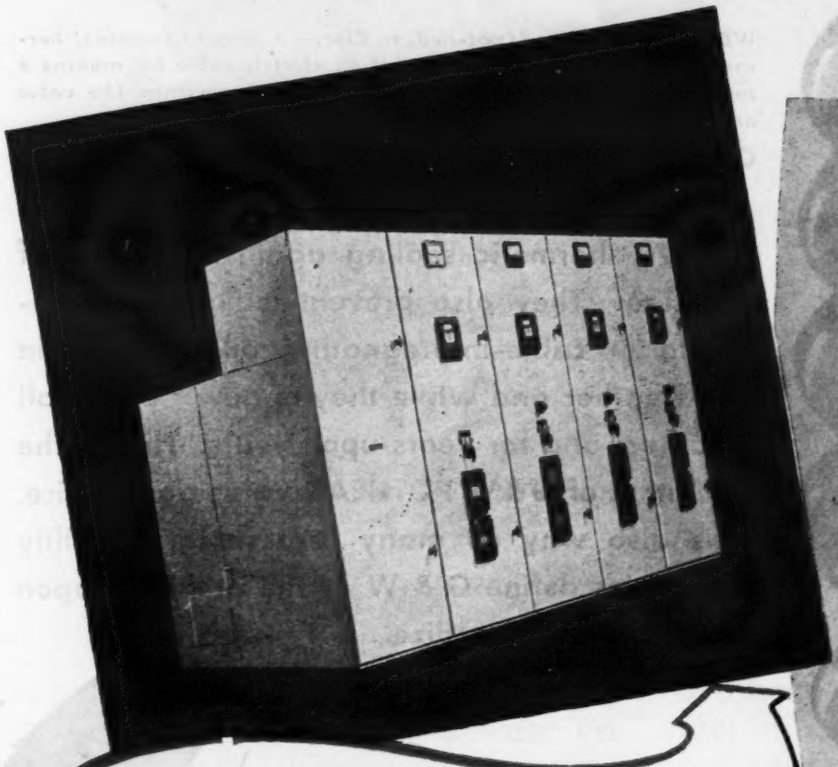
Send for copy of Bulletin No. 392 which lists standardized potheads.

G & W ELECTRIC SPECIALTY CO.
7780 DANTE AVENUE - - - CHICAGO, ILL., U. S. A.
In Canada—Powerlite Devices, Ltd., Toronto

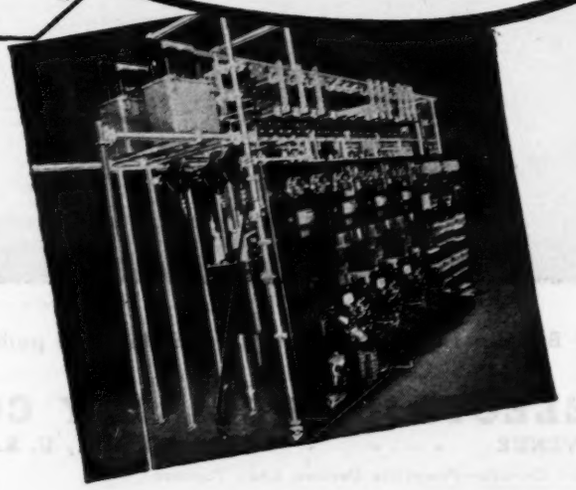
YOU GET ALL 5 WITH "UNITIZED"

★ **1.** Quicker ordering, manufacturing, shipment
★ **2.** Improved service continuity
★ **3.** Complete operating safety
★ **4.** Easy accessibility
★ **5.** Advanced manufacturing and design features

Save up to 30% of



"UNITIZED" DESIGN (above) eliminates delays, hazards and complications of **PIECE-BY-PIECE ASSEMBLY** (below).



THE NEW TIMESAVING
FLEXITEST RELAY CASE

It combines in one compact case, any Westinghouse protective relay or watt-hour meter with KNIFE-BLADE TEST SWITCHES. The FLEXITEST "two-in-one" Relay Case extends "Unitized" simplicity to maintenance and testing operations.

Test connections are easily made from the front by using a multi-circuit test plug or spring-clip leads. Relay is removable for bench or laboratory testing.

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

time formerly required

TO ORDER AND BUILD SWITCHGEAR

We don't claim that you can now order and install the switchgear for a plant or substation as easily as a safety switch, but "Unitized" Switchgear is a long step in that direction.

Complete standardization of ordering and manufacturing procedures, combined with stocks of standard parts and materials, simplify the job beyond anything previously available.

No need for extensive negotiations with separate manufacturers of individual components. No need for the painstaking, laborious selection and co-ordination of ratings. "Special" engineering is eliminated. The steps illustrated at the right reduce the job to its simplest terms.

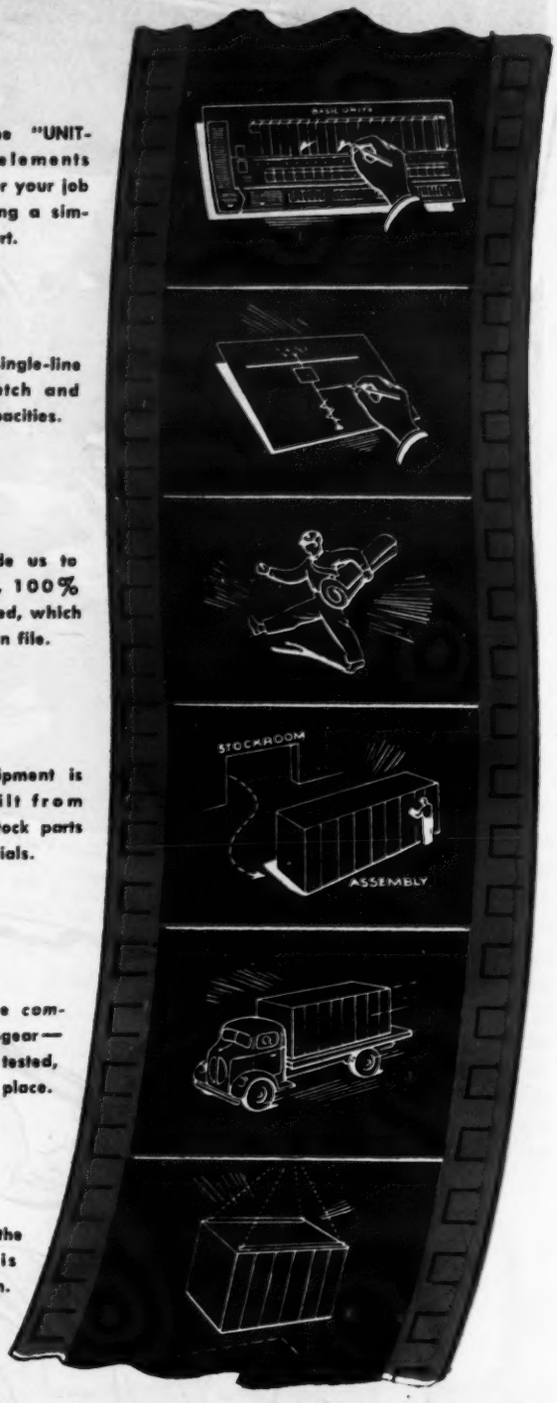
For full information call your nearest Westinghouse office or write Westinghouse Electric & Manufacturing Co., P. O. Box 868, Pittsburgh 30, Pa.

SEND FOR THESE BULLETINS

B-3036 is a complete illustrated manual of Heavy-Duty Air "Unitized" Switchgear. It describes equipment for 2500 and 5000-volt service; 600 to 2000 amperes; 100,000 to 250,000 kva interrupting capacity; draw-out air breakers.

B-3035—Heavy-Duty "Unitized" Switchgear up to 15,000 volts; 100,000 to 500,000 kva interrupting capacity; with oil breakers.

J-60593


Select the "UNITIZED" elements needed for your job by checking a simplified chart.
Draw a single-line circuit sketch and specify capacities.
These guide us to drawings, 100% standardized, which we keep on file.
STOCKROOM
ASSEMBLY
Your equipment is then built from standard stock parts and materials.
You receive complete switchgear—wired and tested, ready to set in place.
Connect, and the complete unit is ready for operation.

"UNITIZED" SWITCHGEAR

WESTINGHOUSE "UNITIZED" SWITCHGEAR IS AVAILABLE WITH AIR OR OIL BREAKERS TO MEET EVERY REQUIREMENT

87 INSULATORS DAMAGED

Shots at Insulators Imperil Power to City War Plants

Thoughtless hunters taking target practice shots at insulators on the Central New York Power Corp. 33,000-volt feeder line in the southeastern section of Syracuse and the town of Onondaga have endangered the power supply to several war plants, to hospitals of the Syracuse Medical center, railroad yards and broadcasting stations.

Within 10 days 87 insulators, which come within the classification of critical war materials, were shattered. The line was saved because the damage took place principally during a period of good weather, which prevented the damaged insulators from flashing over. Prompt discovery of the wrecked insulators was another factor.

Moisture penetrating the broken insulators would have caused them to conduct current and short circuit the line, John Roy, superintendent of electric distribution for the power company, said yesterday.

Four youths arrested on malicious mischief charges by Trooper Frank Stritter of Lafayette were questioned by Assistant District Attorney Frank DelVecchio prior to arraignments before Justice Darwin N. Camp at Nedrow. Power company representatives were present when the youths admitted in the district attorney's office they wrecked 15 to 20 of the insulators.

The youths, Bernard O'Donnell, 16, of 135 Oakley dr., James Sauer, 16, of 1031 S. Geddes st., Irving French, 18, of 5446 S. Salina st., and James Vollmer, 16, of 121 Roswell ave., Nedrow, pleaded guilty and paid $10 fines. They said they did not understand the serious possibilities of breaking the insulators.

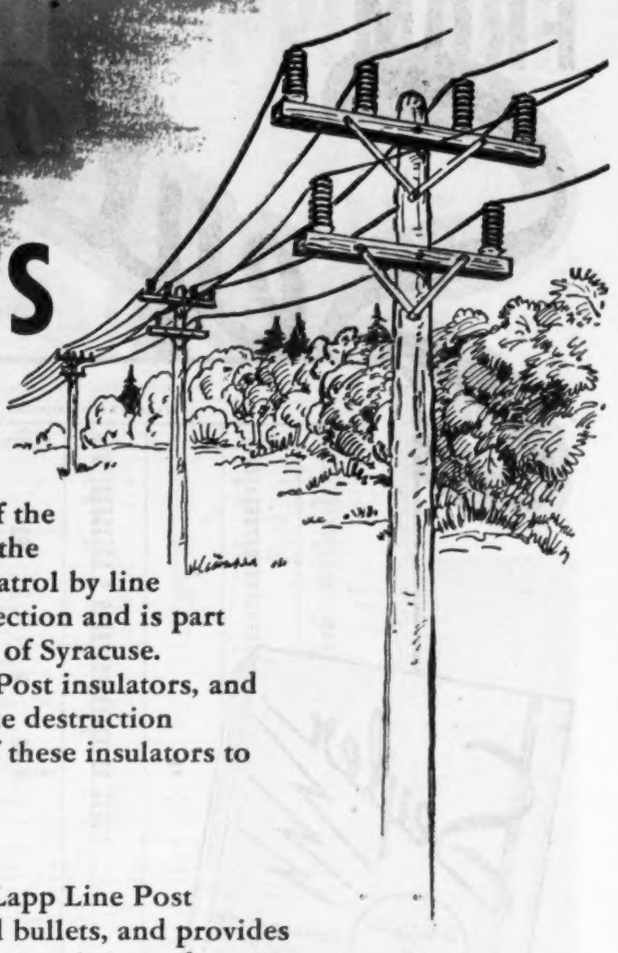
As a number of other persons have wrecked insulators in the same section, the investigation is being continued, and DelVecchio stressed yesterday the danger of serious interruption of the work of war plants.

The 33,000-volt line, Roy said yesterday, feeds out of the Teall ave. substation on the north, loops around the city on the east and south and back into the Solvay substation. Line patrolmen discovered the damage in the area on the hill east of the 5900 block of Salina st., Nedrow, Roy disclosed.

POWER LINE DAMAGED—Line Patrolmen Joseph Duda (left, above) and Frank Keppler examining some of the 87 insulators from a 33,000-volt power line damaged by high-power rifle bullets fired by hunters.

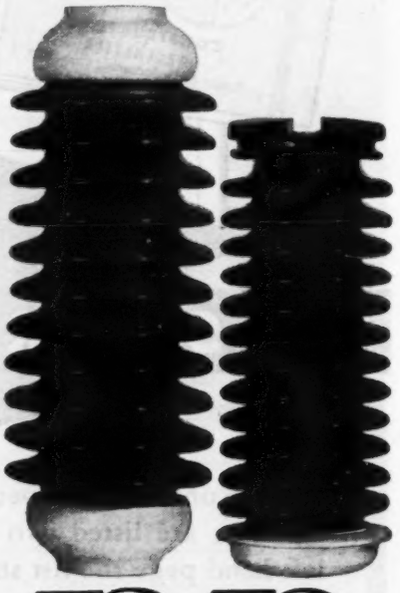
..NO OUTAGES...

LAPP LINE POSTS



THE STORY: The amazing circumstance of 87 insulators badly damaged by high power rifle bullets . . . without any interruption of service . . . is the experience of the Central New York Power Corp. No line outage signalled the trouble, and the damage was discovered only on routine patrol by line maintenance men. The line is in a secluded and wooded section and is part of a double-circuit 33 Kv. feeder line which loops the city of Syracuse. The line was reinsulated in 1938 and 1939 on Lapp Line Post insulators, and the fact that no serious trouble resulted from this wholesale destruction is largely credited by maintenance officials to the ability of these insulators to withstand mechanical shock.

THE MORAL: The design conception of the Lapp Line Post insulator anticipated the possibility of attack by stones and bullets, and provides as nearly an indestructible unit as the industry has ever known. A rugged one-piece post body carries multiple short petticoats of such section thickness that under severe attack, the petticoats fracture off, leaving the body undamaged. Loss even of several petticoats does not substantially reduce leakage distance or flashover path. For duty in areas where such attack is likely, as well as for service under excessive dirt conditions, where radio interference is a problem—wherever the load must be carried dependably—Lapp Line Posts offer a *plus* in safety—and economy.



"Picked for Severe Duty"

"..Save Man-Hours"

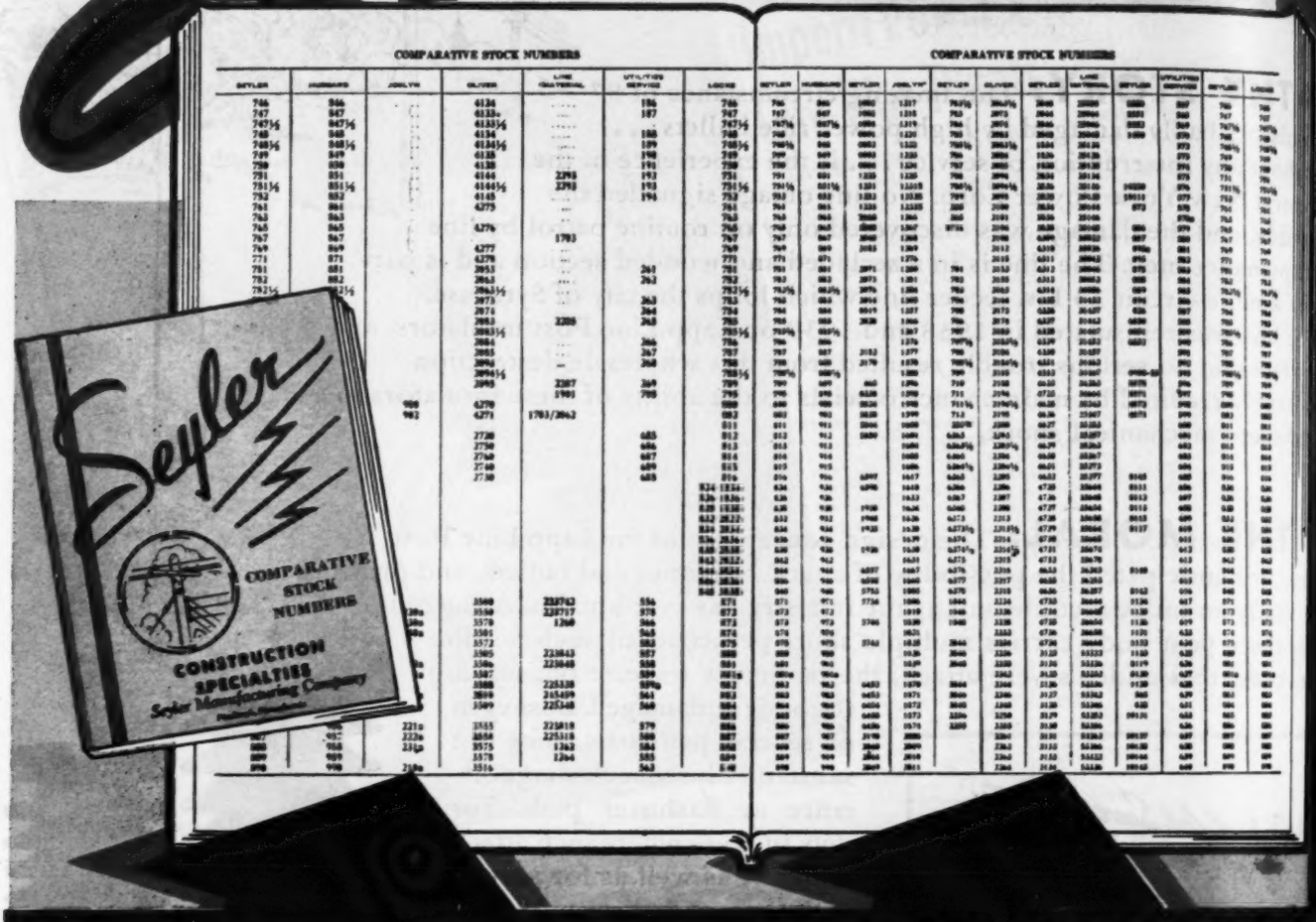
"When we went into our line modernizing program seven years ago, we picked Lapp Line Posts as 'insulator-most-likely-to-succeed' for transmission line duty under difficult conditions. We've never had a line fail from Line Post insulator failure. And we've saved a lot of man-hours on insulator cleaning and insulator replacement. The shooting scrape of last fall, although not the first experience with this sort of trouble, only serves to emphasize the dependability of Lapp Posts."

... General Superintendent of Electrical Operations, Central New York Power Corp.

Lapp

LAPP INSULATOR COMPANY, INC., LE ROY, N. Y.

FROM Seyler ...A USEFUL CONSTRUCTION SPECIALTIES



THE SEYLER MANUFACTURING COMPANY

In the construction Specialties book the numbers are listed two ways—on each left hand page the list starts with lowest Seyler number and all numbers of other manufacturers are matched against the Seyler numbers.

If you know the Seyler stock number you can readily find the comparable stock number for the same item made by any of the other manufacturers.

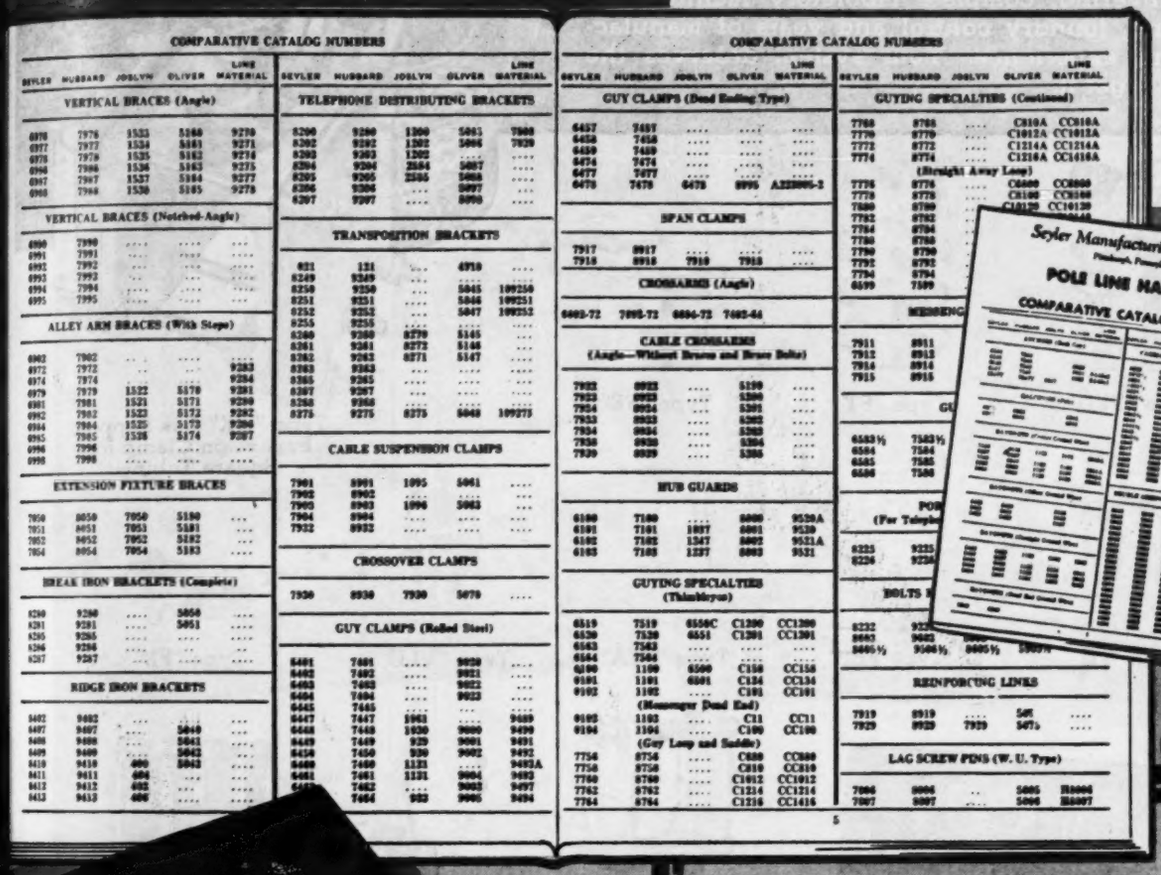
On each right hand page the list starts with the lowest catalog number of each of the other manufacturers and the comparable Seyler number for any item is listed in the column to the left of the known manufacturers number.

If you know the stock number for any item made by any of the manufacturers listed you can easily find the Seyler stock number for the same item.

GUIDE TO SOURCES OF SUPPLY FOR

Comparative Stock Number Lists

POLE LINE HARDWARE

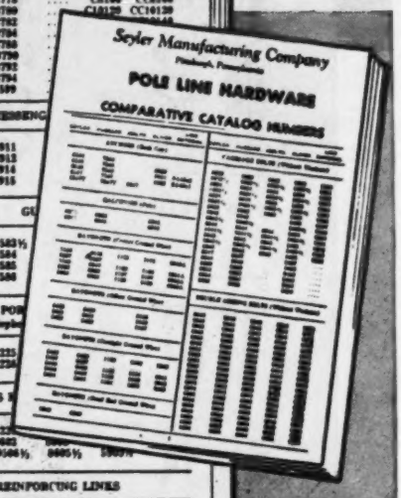

COMPARATIVE CATALOG NUMBERS

SEYLER	HUBBARD	JOSLYN	OLIVER	LINE MATERIAL
VERTICAL BRACES (Angle)				
6976	7976	1533	5160	9270
6977	7977	1534	5161	9271
6978	7978	1535	5162	9274
6966	7966	1536	5163	9275
6967	7967	1537	5164	9277
6968	7968	1530	5165	9278
VERTICAL BRACES (Notched-Angle)				
6990	7990	....	....	....
6991	7991	....	....	....
6992	7992	....	....	....
6993	7993	....	....	....
6994	7994	....	....	....
6995	7995	....	....	....
ALLEY ARM BRACES (With Steps)				
6982	7982	....	....	....
6972	7972	....	....	9283
6974	7974	....	....	9284
6979	7979	1522	5170	9281
6981	7981	1521	5171	9280
6982	7982	1523	5172	9282
6984	7984	1525	5173	9286
6985	7985	1528	5174	9287
6996	7996	....	....	....
6998	7998	....	....	....
EXTENSION FIXTURE BRACES				
7050	8050	7050	5180	....
7051	8051	7053	5181	....
7052	8052	7052	5182	....
7054	8054	7054	5183	....
BREAK IRON BRACKETS (Complete)				
9280	9280	....	5050	....
9281	9281	....	5051	....
9285	9285	....	....	....
9286	9286	....	....	....
9287	9287	....	....	....
RIDGE IRON BRACKETS				
9402	9402	....	....	....
9407	9407	....	5040	....
9408	9408	....	5041	....
9409	9409	....	5042	....
9410	9410	400	5043	....
9411	9411	404	....	....
9412	9412	402	....	....
9413	9413	406	....	....

SEYLER	HUBBARD	JOSLYN	OLIVER	LINE MATERIAL
TELEPHONE DISTRIBUTING BRACKETS				
9200	9200	1300	5001	7000
9202	9202	1302	5006	7020
9203	9203	1303	....	....
9204	9204	2554	5007	....
9205	9205	2555	5008	....
9206	9206	....	5007	....
9207	9207	....	5050	....
TRANSPOSITION BRACKETS				
921	121	....	4910	....
9249	9249	....	....	....
9250	9250	....	5045	109250
9251	9251	....	5046	109251
9252	9252	....	5047	109252
9255	9255	....	....	....
9260	9260	8270	5145	....
9261	9261	8272	5146	....
9262	9262	8271	5147	....
9263	9263	....	....	....
9265	9265	....	....	....
9267	9267	....	....	....
9268	9268	....	....	....
9275	9275	8275	5048	109275
CABLE SUSPENSION CLAMPS				
7901	8901	1095	5061	....
7902	8902	....	....	....
7903	8903	1096	5062	....
7904	8904	....	....	....
7932	8932	....	....	....
CROSSOVER CLAMPS				
7930	8930	7930	5070	....
GUY CLAMPS (Rolled Steel)				
6491	7491	....	9020	....
6492	7492	....	9021	....
6493	7493	....	9022	....
6494	7494	....	9023	....
6445	7445	....	....	....
6447	7447	1051	....	9489
6448	7448	1020	9000	9490
6449	7449	929	9001	9491
6450	7450	930	9002	9492
6460	7460	1121	....	9493A
6481	7481	1151	9004	9492
6482	7482	....	9003	9497
6484	7484	932	9005	9494

SEYLER	HUBBARD	JOSLYN	OLIVER	LINE MATERIAL
GUY CLAMPS (Dead Ending Type)				
6457	7457	....	....	....
6458	7458	....	....	....
6459	7459	....	....	....
6474	7474	....	....	....
6477	7477	....	....	....
6478	7478	6478	8995	A222895-2
SPAN CLAMPS				
7917	8917	....	....	....
7918	8918	7918	7918	....
CROSSARMS (Angle)				
6402-72	7402-72	6806-72	7402-66	
CABLE CROSSARMS (Angle—Without Braces and Brace Bolts)				
7922	8922	....	5150	....
7923	8923	....	5300	....
7924	8924	....	5301	....
7933	8933	....	5302	....
7934	8934	....	5303	....
7930	8930	....	5304	....
7939	8939	....	5305	....
HUB GUARDS				
6180	7180	....	6000	9529A
6181	7181	1037	6001	9530
6182	7182	1547	6002	9521A
6185	7185	1237	6003	9531
GUYING SPECIALTIES (Thimbleeye)				
6519	7519	6556C	C1200	CC1200
6520	7520	6551	C1201	CC1201
6563	7563	....	....	....
6564	7564	....	....	....
6190	1190	6500	C150	CC150
9191	1191	6501	C124	CC124
9192	1192	....	C101	CC101
(Messenger Dead End)				
9102	1102	....	C11	CC11
9194	1194	....	C190	CC190
(Guy Loop and Saddle)				
7754	8754	....	C880	CC880
7758	8758	....	C810	CC810
7760	8760	....	C1012	CC1012
7762	8762	....	C1214	CC1214
7764	8764	....	C1216	CC1416

SEYLER	HUBBARD	JOSLYN	OLIVER	LINE MATERIAL
GUYING SPECIALTIES (Continued)				
7768	8768	....	C810A	CC810A
7770	8770	....	C1012A	CC1012A
7772	8772	....	C1214A	CC1214A
7774	8774	....	C1216A	CC1416A
(Straight Away Loop)				
7776	8776	....	C8800	CC8800
7778	8778	....	C8100	CC8100
7780	8780	....	C10120	CC10120
7782	8782	....	....	....
7784	8784	....	....	....
7788	8788	....	....	....
7790	8790	....	....	....
7792	8792	....	....	....
7794	8794	....	....	....
6199	7199	....	....	....
MESSENG				
7911	8911	....	....	....
7912	8912	....	....	....
7914	8914	....	....	....
7915	8915	....	....	....
GU				
6583½	7583½	....	....	....
6584	7584	....	....	....
6585	7585	....	....	....
6586	7586	....	....	....
POR (For Telephone				
9235	9235	....	....	....
9236	9236	....	....	....
BOLTS				
8232	9232	....	....	....
8602	9602	....	....	....
8606½	9606½	8606½	5606½	....
REINFORCING LINKS				
7919	8919	....	5071	....
7929	8929	7929	5071	....
LAG SCREW PINS (W. U. Type)				
7906	8906	..	5005	H8906
7907	8907	....	5006	H8907


Seyler Manufacturing Company
Pittsburgh, Pennsylvania
POLE LINE HARDWARE
COMPARATIVE CATALOG NUMBERS

PITTSBURGH, PENNA.

The Pole Line Hardware comparative list is arranged alphabetically by product. The catalog numbers of each of the manufacturers are arranged so that the stock numbers for each item line up with the Seyler number.

If you know the catalog number of an item made by one manufacturer you can find the comparable stock number for the same item made by others.

COUPON

The Seyler Manufacturing Company
Box 7827, Sharpsburg P. O.
Pittsburgh, Penna.

Please send me comparative stock number lists for construction Specialties ☐
and Pole Line Hardware ☐

NAME

TITLE

COMPANY

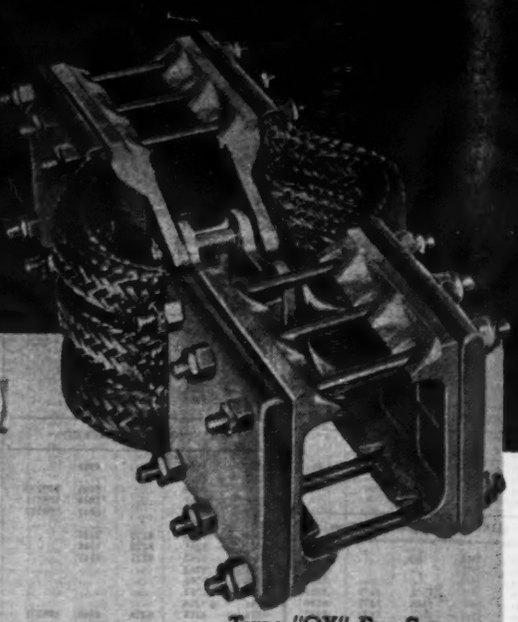
CITY ZONE NO

STATE

GOOD CONNECTIONS ARE VITAL

YOU CAN RELY ON DELTA-STAR FOR TROUBLE-FREE ELECTRIC POWER CONNECTORS OF ALL TYPES

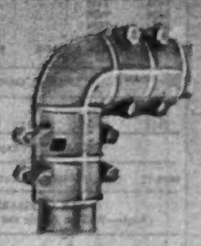
Because - these products are backed up by sound engineering, complete laboratory facilities for testing, foundry control and years of manufacturing experience. Your system deserves the best – get it.



Type "QX" Bus Support Expansion Clamp for Square Tubing

Type "FTD"

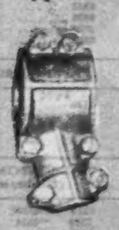
Type "FT"



Type "FE"

Type "TU"

Type FBH"



Type "FTA"

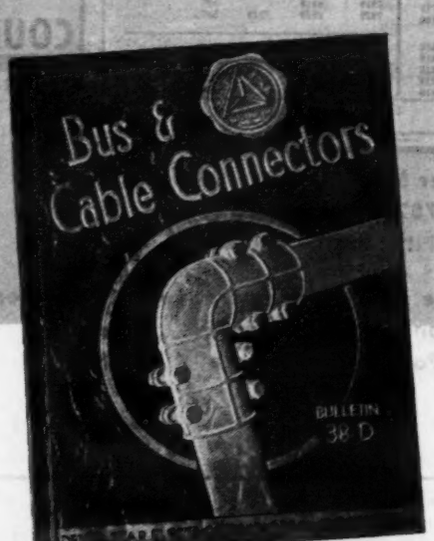
Type "VLU"

Type "FL"

Type "CTB"

Type "LGP"

Type "CT"



Bulletin 38-D lists a complete line of standardized, laboratory and field tested power connectors. Clamp or solder type, for round or square tubing, bar, cable or combinations of these It's yours for the asking.

BUY MORE WAR BONDS – KEEP THOSE YOU HAVE

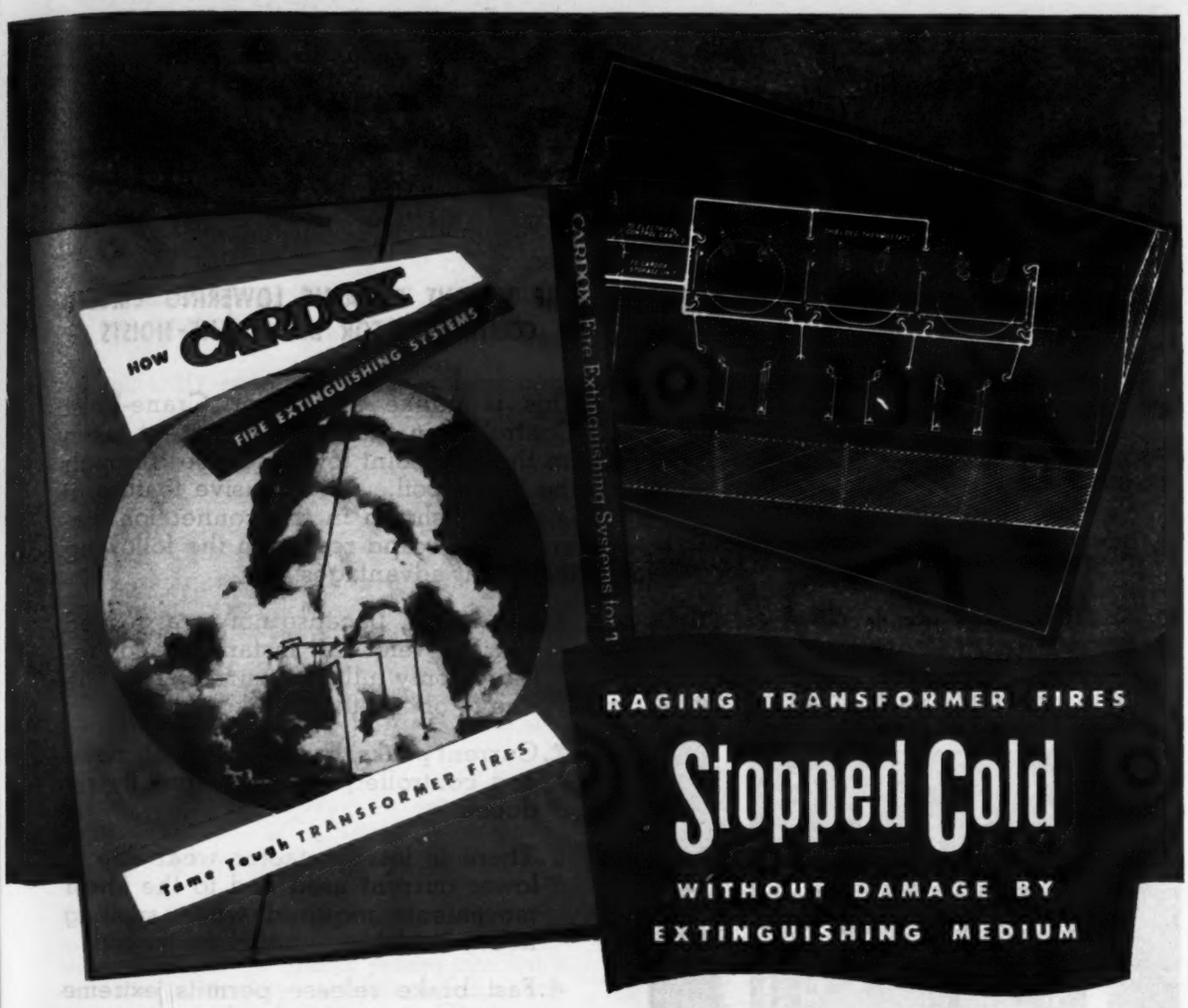
DELTA-STAR ELECTRIC COMPANY

MAIN OFFICE AND FACTORY — 2400 Block, Fulton St., Chicago 12, Ill.
NEW YORK OFFICE — 140 Cedar St., New York 6, N. Y.

DISTRICT REPRESENTATIVES IN THE FOLLOWING CITIES

Birmingham, Ala. · Boston, Mass. · Buffalo, N. Y. · Charlotte, N.C. · Cleveland, Ohio · Dallas, Texas · Detroit, Mich. · Denver, Colo. · Indianapolis, Ind. · Kansas City, Mo. · Knoxville, Tenn. · Los Angeles, Cal. · Minneapolis, Minn. · New Orleans, La. · Norfolk, Va. · Omaha, Neb. · Philadelphia, Pa. · Pittsburgh, Pa. · Richmond, Va. · St. Louis, Mo. · San Francisco, Cal. · Seattle, Wash. · Washington, D. C. · Honolulu, Hawaii

CANADIAN ASSOCIATE
Canadian Line Materials Limited — Toronto 13, Canada



As every power man who has ever experienced one will testify . . . transformer fires are plenty tough, and plenty costly if they're not licked quick! And, like other types of electrical equipment, a transformer can be seriously damaged by the wrong fire extinguishing medium.

There's one quick, safe way to lick transformer fires. That's with a mass discharge of non-damaging, non-contaminating carbon dioxide . . . as controlled and applied by a Cardox Fire Extinguishing System . . . engineered for the specific hazard it covers.

How Cardox Systems quickly tame large or small transformer fires, and why those who have seen the phenomenal performance of Cardox Systems against raging transformer fires say the Cardox conception of extinguishment is a significant contribution to practical protection of this vital and costly equipment, is explained fully in the new Cardox Bulletin illustrated above.

Send for this Bulletin today. Read the reprint of File S-63 from the Cardox Case Book. It describes a recent transformer fire detected and extinguished by a Cardox System before nearby personnel were aware the equipment was in danger. Management estimates damage of at least $150,000 would have been unavoidable but for the prompt, non-damaging extinguishment by Cardox.

Bulletin also shows actual step-by-step extinguishment of test transformer fire and reprints description and charts covering other tests made for an electric utility company on simulated substation fire involving 3000 gal. of transil oil . . . and extinguished in one minute.

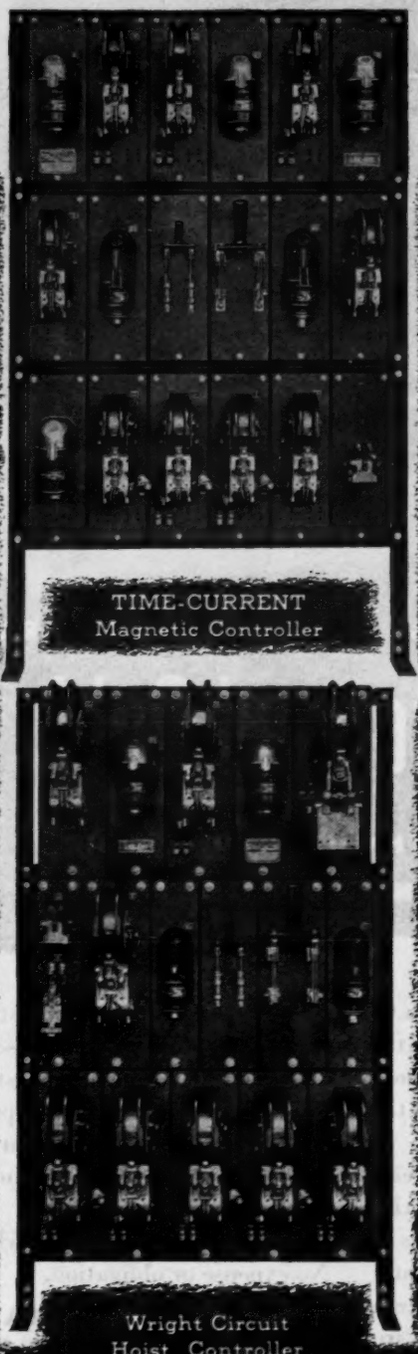
Write for new Bulletin 545 now. No expense or obligation.

CARDOX CORPORATION
BELL BUILDING • CHICAGO 1, ILLINOIS
New York • Washington • Detroit
Cleveland • Atlanta • Pittsburgh
San Francisco • Los Angeles • Seattle

CARDOX
CO_2 FIRE EXTINGUISHING SYSTEMS

Cardox CO_2 is supplied instantly in pounds or tons from a single Storage Unit containing 500 pounds to 125 tons at controlled low temperature of 0°F and 300 p.s.i.

Good Cranes

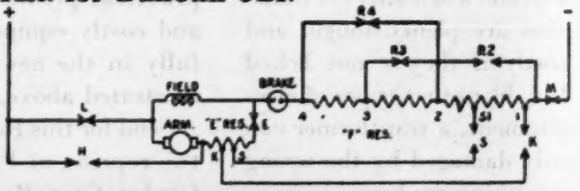


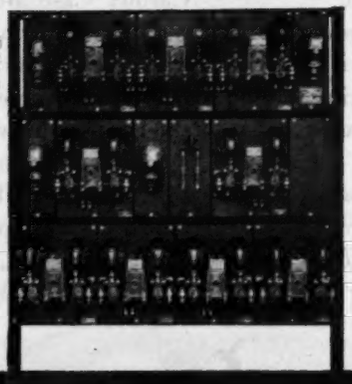
THE WRIGHT DYNAMIC LOWERING CIRCUIT CONTROLLER FOR D.C. CRANE-HOISTS

This is unlike any other Crane-Hoist Controller in that all the current taken on the first point lowering goes through the brake coil. An exclusive feature, it is clearly shown in the connection diagram below and results in the following important advantages:

1. The brake, because not in a divided circuit, releases instantly and requires only full load current from the line to obtain this quick response.
2. Current peaks, handled by both motor and controller, are consequently reduced.
3. There is less contactor wear due to lower current used and to the fewer movements required when spotting heavy loads.
4. Fast brake release permits extreme accuracy in setting loads.

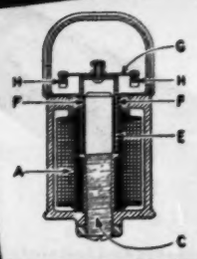
Ask for Bulletin 921.





DUPLEX Control for 2-motor-drives

Insures each motor assumes its share of the load — no unbalanced condition to cause mechanical strain or uneven distribution of power taken by either motor. Also made for 4-motor-drives.



TIME-CURRENT Relay

Consists of a series-wound coil, A, with a simple metallic sleeve, E, carrying the contacts. An adjustable steel core, C, threaded into the case permits quick, simple method of adjustment.

THE ELECTRIC

2698 EAST 79TH STREET

Deserve Good Equipment

THE TIME-CURRENT MAGNETIC CONTROLLER FOR BRIDGE AND TROLLEY MOTIONS

An instantly responsive method for controlling acceleration according to the load. It gives fast acceleration on no-load—an important advantage in permitting the operator to take the "swing" out of the load. This unit automatically increases the time-interval per step as the load increases, allowing the motor more time to get under way and giving smooth operation. Under abnormal conditions, it forces the acceleration until the motor starts or is disconnected from the line by tripping of the overload relay.

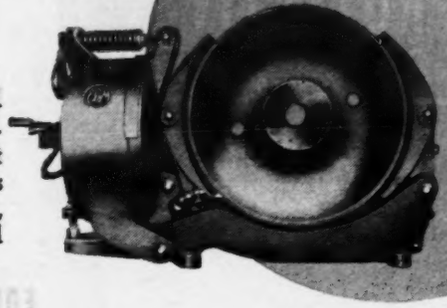
Ask for Bulletin 921.

FEATHER TOUCH Control

EC&M Master Switches are noted for their easy operation which lessens fatigue and allows quick response to motor-driven machines. Narrow width allows several to be lined up side by side—and *all* easy to reach.

TYPE WB BRAKE for HOIST

Radically different from any other brake in that no levers, rods, or other parts of the brake pass over the top of the brake wheel. Thick molded brake blocks permit 1/8" to 1/4" wear before re-blocking is necessary. Convenient hand-release for emergency operation, changing armatures, shoes, etc.



A STANDARD OF VALUE

For many years, EC&M has led in the development of extremely sturdy, highly efficient electrical equipment for cranes, putting into it that extra margin of safety and quality which insures uninterrupted service to the user. The symbol, EC&M, has come to be regarded as a standard of value—as its own guarantee.

EC&M builds a complete line of similar control for a.c. cranes and also control for floor-operated cranes.

YOUNGSTOWN SAFETY LIMIT STOP

Not only disconnects motor from the line but brings the hook to rest quickly by dynamic braking. Removes fear of over-hoisting accidents and allows operator to do better work. A crane without a Youngstown is as risky as a boiler without a safety valve.

CONTROLLER & MFG. CO.

CLEVELAND 4, OHIO

WHICH MEETS YOUR

LIGHTNING PROTECTIVE REQUIREMENTS

BEST ?

Consult your

WESTINGHOUSE DISTRIBUTOR

FOR THE ANSWER TO DISTRIBUTION APPARATUS PROBLEMS

YOUR WESTINGHOUSE DISTRIBUTOR can give you up-to-date specifications, prices and application data on a complete range of distribution apparatus. Ask him to put you on his mailing list for new literature. Westinghouse Electric & Manufacturing Co., P.O. Box 868, Pittsburgh 30, Pa.

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

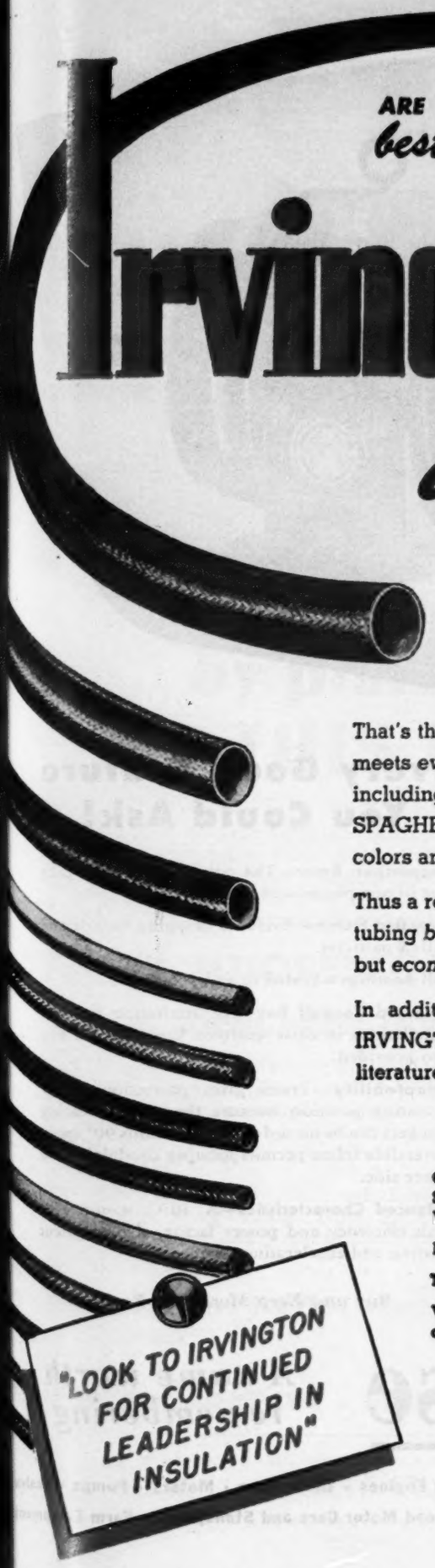
Lightning protection for vital equipment is a "must" which every operating man must face. Selection of the correct protective equipment often is a tough problem—and here is where Westinghouse can help you.

Backing your Westinghouse Distributor is a complete line of lightning protective equipment . . . the result of more than a half-century of engineering research. The broad Westinghouse experience in *applying* protective equipment also can help you. Take the case of the Types A and LV Arresters illustrated above. It might seem that these arresters are identical in function—and they are, in nine applications out of ten. But, for instance, when it comes to protection of rotating equipment, they each have their particular place. This "know-how" is yours for the asking . . . from your Westinghouse Distributor.

Lightning protective equipment is only one of the hundreds of products which your Westinghouse Distributor can supply you to help keep your system up to par. Ask him to help you check up *now* on lightning protection. J-60

ARE YOU USING THE TUBING *best* SUITED FOR YOUR JOB?

Irvington *can Supply it*



BEST suited means a varnished tubing or sleeving that meets *every* service requirement . . . *at lowest cost!*

That's the way IRVINGTON . . . long the leader in electrical insulation . . . meets *every* tubing or sleeving need. For IRVINGTON makes *all* the types including non-fraying FIBERGLAS . . . high voltage IRV-O-VOLT . . . RADIO SPAGHETTI and SATURATED SLEEVINGS . . . in a complete range of colors and A. S. T. M. sizes.

Thus a recommendation from IRVINGTON can be unbiased . . . you get the tubing *best* suited to your needs. not only from the standpoint of efficiency, but *economy* as well.

In addition, you get that extra increment of electrical surety which IRVINGTON'S 'know how' and 'manufacturing control' provides. For literature, or engineering assistance, write to Dept. 46.

IRVINGTON PRODUCTS:

- Cotton, Fiberglas, or Rayon Tubings and Sleevings — Varnished, Lacquered, or Vinylite Processed
- Non-Fraying Fiberglas Sleeving
- Transformer Lead Tubings
- Wire Identification Markers—Varn'shed or Plastic
- Extruded Plastic Tubings
- Fibron Plastic Tapes
- Varnished Fabrics and Papers
- Slot Insulations
- Harvel and Irvington Insulating Varnishes
- Cardolite Resins

IRVINGTON

VARNISH & INSULATOR COMPANY

Irvington 11, New Jersey

COOL under the most difficult conditions

A UNIQUE and exclusive feature of the new Fairbanks-Morse general-purpose motor in frames 224 to 365 inclusive is its cross-flow ventilation.

Air is taken in at each end, flows through separated passages across the stator core, and is exhausted simultaneously at both ends, as shown by arrows on the cut-away view. The results—uniform cooling, freedom from hot spots, longer motor life.

Cross-flow ventilation as well as other advanced features put this motor out in front in stamina, in protection, and in versatility. To appreciate fully what it can do for you, see it demonstrated. Write Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago 5, Illinois.

Every Good Feature You Could Ask!

Copperspun Rotor—The *only* rotor centrifugally cast in one piece—and of *copper*.

Protected Frame—Excludes dripping liquids and falling particles.

Ball Bearings—Sealed in and protected.

Recessed Conduit Box—An innovation for neat installations in close quarters. Conventional box also provided.

Adaptability—Frame gives protection in any mounting position because the vented bearing brackets can be turned to four positions 90° apart. Reversible frame permits locating conduit box on either side.

Balanced Characteristics—A 40°C. motor with high efficiency and power factor, also excellent starting and accelerating torques.

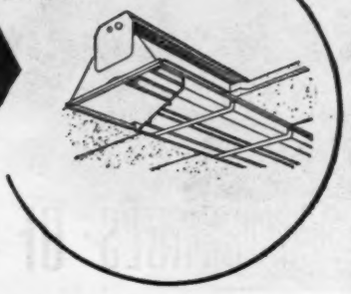
Buy and Keep More War Bonds

Fairbanks-Morse

A name worth remembering

Diesel Locomotives • Diesel Engines • Generators • Motors • Pumps • Scales
Magnetos • Stokers • Railroad Motor Cars and Standpipes • Farm Equipment

THIS was created by planning around THIS Lighting



This beautiful — and practicable — interior grew from the lighting.

It grew *easily*, because versatile Miller Fluorescent Troffer lighting systems are engineered to simplify planning and to simplify construction. It grew *beautiful*, because Miller Fluorescent Troffer lighting systems are esthetically sound. It grew *useful*, because they are one of the outstanding lighting achievements of our time.

MILLER FLUORESCENT TROFFER LIGHTING SYSTEMS

for stores, schools, offices, factories and public buildings

are readily installed as single units, blocks, geometric patterns or light-strips "by the mile." They harmonize with interiors and even suggest themes for the entire building. There is a wide choice of glass or plastic lenses, plates, and metal or plastic grilles. A choice designed to meet specific lighting requirements.

The Miller patented bracket ends laborious fitting of recessed lighting systems into hung ceilings. Now, these brackets are mounted from the structural ceiling and support *both* the hung ceiling and the Troffer lighting system.

Miller distributors and field engineers are conveniently located to serve you.

OTHER MILLER TROFFER FEATURES:

- *Supports from structural ceiling cut 50 to 75%.*
- *Conduit and conduit fitting costs reduced up to 80%.*
- *Wiring costs reduced up to 50%.*
- *Permanent operation and maintenance economies.*

THE MILLER COMPANY • MERIDEN, CONNECTICUT

ILLUMINATING DIVISION
Fluorescent, Incandescent Mercury Lighting Equipment

OIL GOODS DIVISION
Domestic Oil Burners and Liquid Fuel Devices

ROLLING MILL DIVISION
Phosphor Bronze and Brass in Sheets, Strips and Rolls

WAR CONTRACTS DIVISION
War Materiel

MILLER
SINCE 1844

ADVANTAGES OF THERMOPLASTIC

There are fourteen practical advantages of theremoplastic insulation over older types of construction . . . advantages which PLASTIC engineering now makes possible at what, in most cases, is NO PRICE PREMIUM. Check them yourself: 1. Superior aging properties, 2. High resistance to oxidation, 3. Low moisture absorption, 4. High dielectric strength, 5. High tensile strength, 6. Resistance to flame, 7. Flexibility at low temperatures, 8. Resistance to abrasion, 9. Resistance to chemicals, 10. Resistance to oils and greases, 11. Ease of installation, 12. Increased capacity, 13. Attractive appearance, 14. Broad color range. Remember . . . when you're thinking of PLASTIC you're thinking of US!

Thermoplastic insulation specialists . . . producing a complete line from fine wires to heavy power cables . . . serving: Public Utilities, Radio, Electronic, Appliance and Instrument Manufacturers, Telephone Companies and Contractors.

PLASTIC

WIRE & CABLE CORPORATION

NORWICH CONN.

Preferred for line construction and maintenance trucks, the FWD Model HST embodies the accumulated experience of 35 years of FWD leadership in four-wheel-drive trucks.

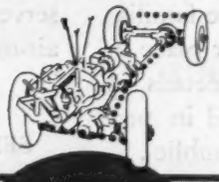
HOW FWDs ARE Easing the Manpower Shortage FOR UTILITIES

Despite wartime handicaps . . . manpower shortages, over-worked equipment and other limitations . . . utilities are meeting unprecedented emergency demands. FWD trucks are helping more than 150 utility companies maintain their traditional reputation for unfailing service.

FWDs add to the work range and capacity of available crews and equipment. On or off the pavement, cross-country or on main highways, FWDs get through to location. The extra dependability — the full power and traction of four driving wheels — the rugged construction where ruggedness counts — the ability to haul longer for less in gas, oil, tires and maintenance — have won for FWDs preferred ranking as tough, unusually able line-construction and maintenance trucks.

FOR ESSENTIAL INDUSTRIES, a limited number of FWDs will be available this year. Phone, wire or write us, or see the nearest authorized FWD dealer.

THE FOUR WHEEL DRIVE AUTO CO.
Clintonville, Wisconsin
Canadian Factory: KITCHENER, ONTARIO



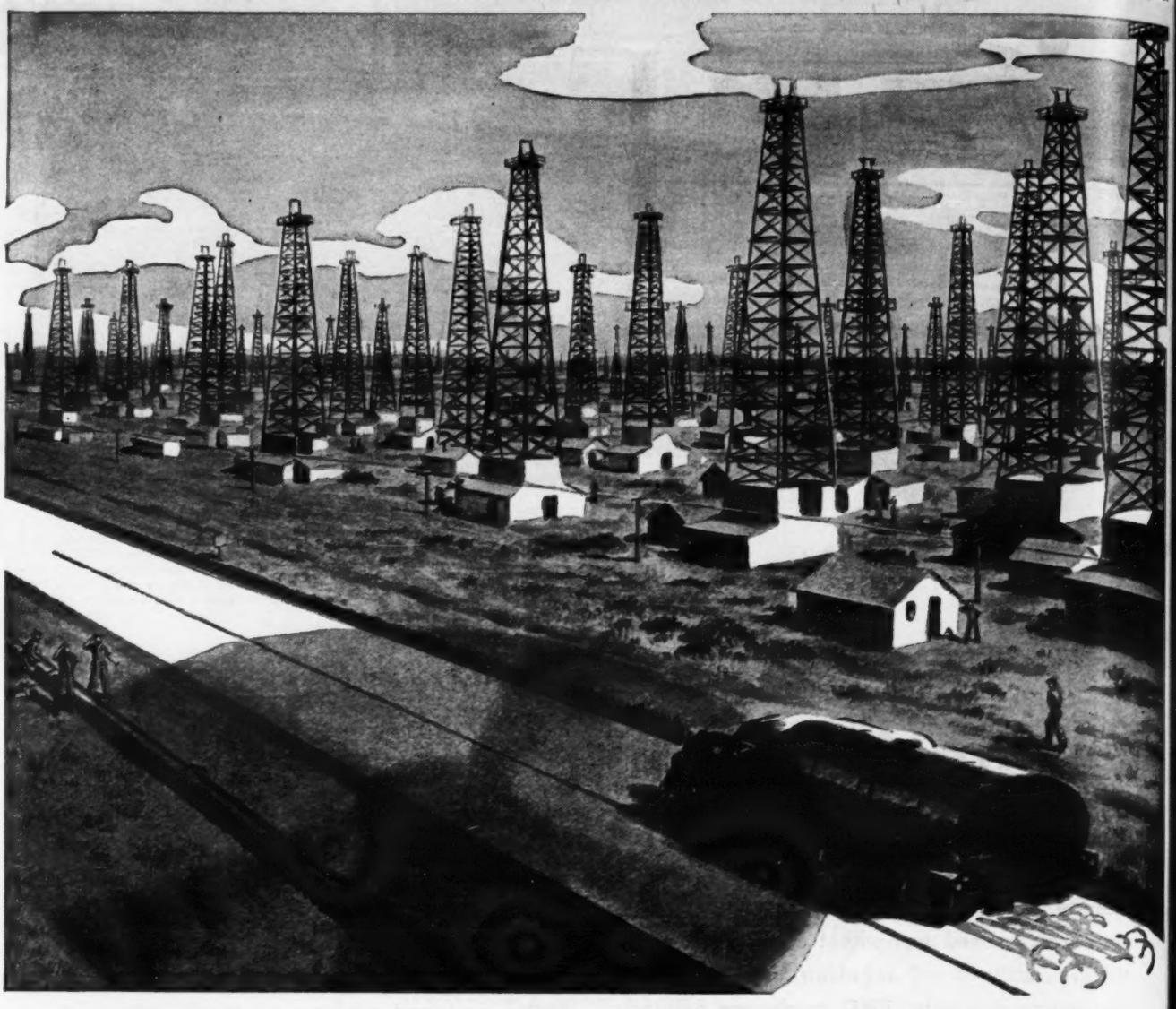
This FWD Model HS with body built expressly for utility service, is helping Hydro Electric Power Commission, Toronto, Canada, to solve manpower problems.

FWD TRUCKS

THE ORIGINAL EXCLUSIVE BUILDERS OF FOUR-WHEEL-DRIVE TRUCKS

With this 5-man cab-over-engine FWD Model HST, the Oconomowoc (Wisconsin) Water & Light Department is maintaining service regardless of manpower handicaps.

★ NUMBER 13 IN A SERIES OF MESSAGES BY KELLETT AIRCRAFT CORPORATION ★



"COMING EVENTS CAST THEIR SHADOWS . . ."

Over busy cities . . . industrial scenes . . . rolling farm country . . . wild, wooded regions, the shadows of rotary wings will be familiar sights . . . as helicopters take their place in future air transportation. Today, details of helicopter advances in design and in performance are not available to the public . . . but the progress made during the war, under Government sponsorship, promises a practical, useful type of aircraft with special flying abilities, freeing it from airport limitations. Kellett's experienced engineers and production organization look forward confidently to the time when the helicopter will serve alongside conventional aircraft, in the air-minded world of tomorrow.

. . .

SEND FOR INTERESTING BOOKLET

Are there questions in your mind about what the helicopter can do, its capacity, cost or speed? Send for "Answering Some Helicopter Questions." Kellett Aircraft Corporation, Dept. E, Upper Darby (Philadelphia), Pa.

KELLETT

OLDEST ROTARY WING AIRCRAFT MANUFACTURING COMPANY

NOW · When You Specify

JEFFERSON UNION *Renewable* FUSES

You Can Be Sure to Get Them

KEEPING electrical horsepower on the job—keeping manufacturing production up—and giving safe protection to electrical equipment without unnecessary shutdowns or damage are reasons for specifying and installing reliable fuses.

Jefferson-Union Renewal Links are of the multi-notched type, providing reliable protection under normal and severe operating conditions. The notches in the center of the link localize the heat generated during operation, producing lower temperatures at the fuse terminals. When subjected to heavy overloads or short circuits, the multiple restricted portions of the link are fused and serve to break the arc in several places, thus a minimum amount of metal is volatilized and minimum internal pressure is generated within the fuse. The design of this link insures maximum performance and long-life for the fuse.

Jefferson Renewable Fuses prevent needless interruptions and guard against damage. When excessive overloads require these fuses to open, they do it safely and reliably. Their rugged construction and simple design insure long years of service and easy renewal. JEFFERSON ELECTRIC COMPANY, Bellwood (Suburb of Chicago), Illinois. *In Canada:* Canadian Jefferson Electric Co., Ltd., 384 Pape Ave., Toronto, Ont.

JEFFERSON ELECTRIC

Increase Your Over-The-Counter Sales

ATTRACTIVE WINDOWS SELL MORE LIGHTS!

PUBLIC utilities can sell more incandescent and fluorescent lamps with these Sylvania Electric promotional helps. Try all three: a 3-piece combination display featuring fluorescent lamps, starters and lamp holders, together with incandescent light bulbs . . . a decalcomania on lighting products . . . and a 5-color card on incandescent light bulbs.

EASY-SELECTION UNITS BUILD SALES, TOO!

WHEN incandescent and fluorescent lamps are easy to get at . . . plainly price-marked . . . displayed neatly according to size . . . that's when they *move fast!* And you can place these dispensers in any part of the selling area.

SYLVANIA ELECTRIC'S eye-catching, point-of-sale aids will help fill that empty socket and replace that dead bulb!

HIGH VOLUME SALES HELP MAINTAIN CONNECTED LOAD!

TO consistently maintain connected load, to put back into use that empty socket or replace that dead bulb—that's what this entirely new black-and-green counter merchandiser for incandescent lamps aims to do! It sells the "Best Light In Sight." This same idea is stressed in a 5-color counter card . . . equally effective as a window streamer.

AND HANDY-SPOT REMINDERS PREVENT FORGETTING!

TO take the place of that string around the finger—and be twice as effective in reminding customers that now is the time to buy those long-needed lamps—Sylvania has prepared these handy reminder cards . . . store banners . . . five-pennant festoons . . . COP Starter Displays (with holder for descriptive folders).

All these Sylvania promotion pieces are ready *now*, to build all-around business for *you*. Stock up on all these items—they'll be of immeasurable help! Write Sylvania Electric for more information.

SYLVANIA ELECTRIC

SYLVANIA ELECTRIC PRODUCTS INC., Salem, Massachusetts

MAKERS OF FLUORESCENT LAMPS, FIXTURES, ACCESSORIES; INCANDESCENT LAMPS; RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES

PINCO
INSULATORS

42 To obtain the strength needed for heavy duty switch and bus service accurate alignment of porcelain shell is required. This Pinco developed assembly jig assures maximum strength in the 69 kv. Pinco No. 606 unit, shown, through elimination of unequal load distribution. A vibrator as part of the jig eliminates cement voids.

The assembly of an insulator is a complex and precise operation. The care and the exactness with which it is done, and the inspections which accompany each operation, determine to a large extent the strength and the performance of the insulating unit.

This is the eighth in a series of advertisements—the second on insulator assembly—showing how Pinco Insulators are made by the wet plastic process in which all forming operations are performed with the clay in plastic state.

Write for your copy of the Pinco Catalog showing Pinco Standard Insulators and Hardware.

Pinco Standard Insulators are cataloged in the Electrical Buyers Reference.

43 To insure accurate and easy stack assembly in the field, this master type jig, also developed by Pinco, aligns cap and pin to within .0003″ of parallelism. Thousands of these Pinco No. 735 units are in service on all voltages, including seven-unit stacks at 220 kv.

44 All Pinco Insulators in which metal is cemented to porcelain are steam-cured after cementing in these masonry rooms where temperature and humidity can be accurately controlled for optimum curing conditions. The high temperature sets the cement while the metal is expanded so providing highest possible strength in the bond.

Suspension Insulators . . . . Switch & Bus Insulators . . . . Distribution Pin Types and Guy Strai
. . . . One Piece & Multi-part High Voltage Pin Types . . . . Suspension & Strain Clamps . .

45 After assembly, each Pinco unit is given a strength test on an automatic machine before the final electrical test. Here, Pinco No. 1070 fifteen thousand pound units are being subjected to a pull of 40% of their rating to make sure that they will be "Right On the Job."

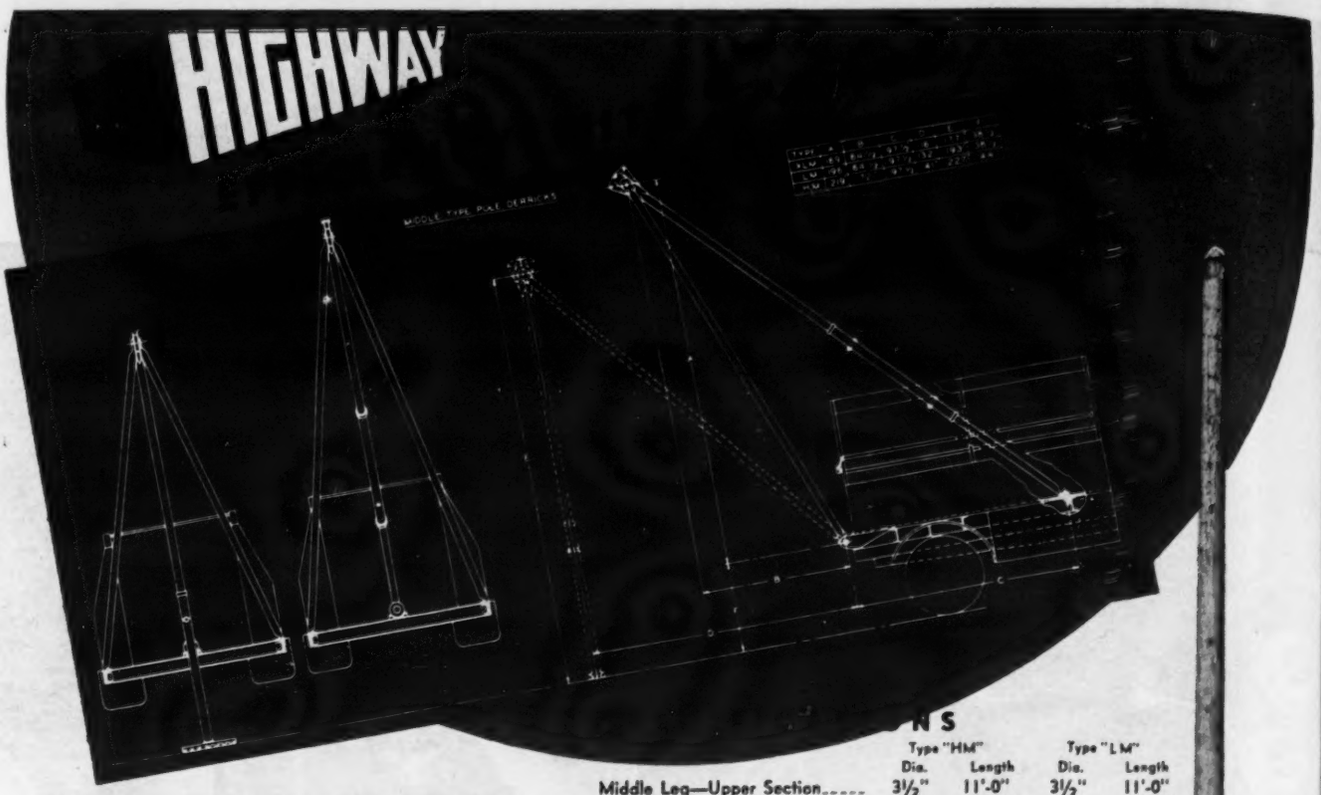
PINCO
No. 1070

The Porcelain Insulator Corporation

659 Main Street, Lima, New York

SALES AGENTS—JOSLYN MFG. & SUPPLY CO., Chicago 6, Ill.; Kansas City 16, Mo.; Monticello 2, Ind.; Omaha 4, Neb.; Springfield, Ill.; The Joslyn Company, New York 5, N. Y.; Baltimore 25, Md.; Philadelphia 2, Pa.; Richmond 21, Va.; Rochester 10, N. Y.; Washington 8, D. C.; South East Joslyn Co., Cincinnati 7, Ohio; Atlanta 3, Ga.; Cleveland 13, Ohio; Jacksonville, Fla.; Lexington, Ky; Jobbers Supply Company, St. Paul 4, Minn., Portland 9, Ore.; Seattle 4, Wash.; Southern Joslyn Co., New Orleans 19, La.; Joslyn Southwest Co., Dallas 1, Tex.; Houston 4, Tex.; Joslyn Co. of California, Los Angeles 11, Calif.; San Francisco 3, Calif.; H. E. Burns, Pittsburg, Pa.; Paul A. Douden Co., Denver 2, Colo.; Paul Carson, Amarillo, Tex.; J. J. Costello, Boston 16, Mass.

istribution Clamps . . . . Transmission Line Fittings . . . . Transformer & Circuit Breaker Bush-
gs . . . . Indoor Bus Support Porcelain . . . . Tree Insulators . . . . Lightning Arrester Porcelain



MIDDLE TYPE POLE DERRICKS

FOR USE WITH SINGLE DRUM WINCHES

N S

	Type "HM" Dia.	Type "HM" Length	Type "LM" Dia.	Type "LM" Length
Middle Leg—Upper Section	3½"	11'-0"	3½"	11'-0"
Middle Leg—Middle Section	4¼"	9'-11"	4"	8'-0"
Middle Leg—Lower Section	2¾"	6'-4"	2¾"	6'-3"
Side Leg	3½"	19'-5"	3½"	17'-6"
Pole Capacity	55'—2500 lbs.		45'—2000 lbs.	
Weight	564 lbs.		428 lbs.	

• HIGHWAY Middle Type Pole Derricks are accepted as standard by many utility organizations. They are available in two sizes — the LM for use with 1½- and 2-ton trucks will handle 45' and 50' poles and the HM for use on larger trucks will set poles 50' to 60' in height.

The derrick legs are made of special alloy seamless and heat treated steel tubing to secure light weight combined with strength and safety. The middle leg is made in three sections, permitting height adjustment of the derrick head and also permitting its use as a prop for pulling poles.

The MC Pole Derrick Supports are made in three pieces and are easily and quickly adjusted to the required height. When fully telescoped, the supports swing up under the platform where they are carried while the truck is in motion.

HIGHWAY TRAILER COMPANY

MANUFACTURERS OF

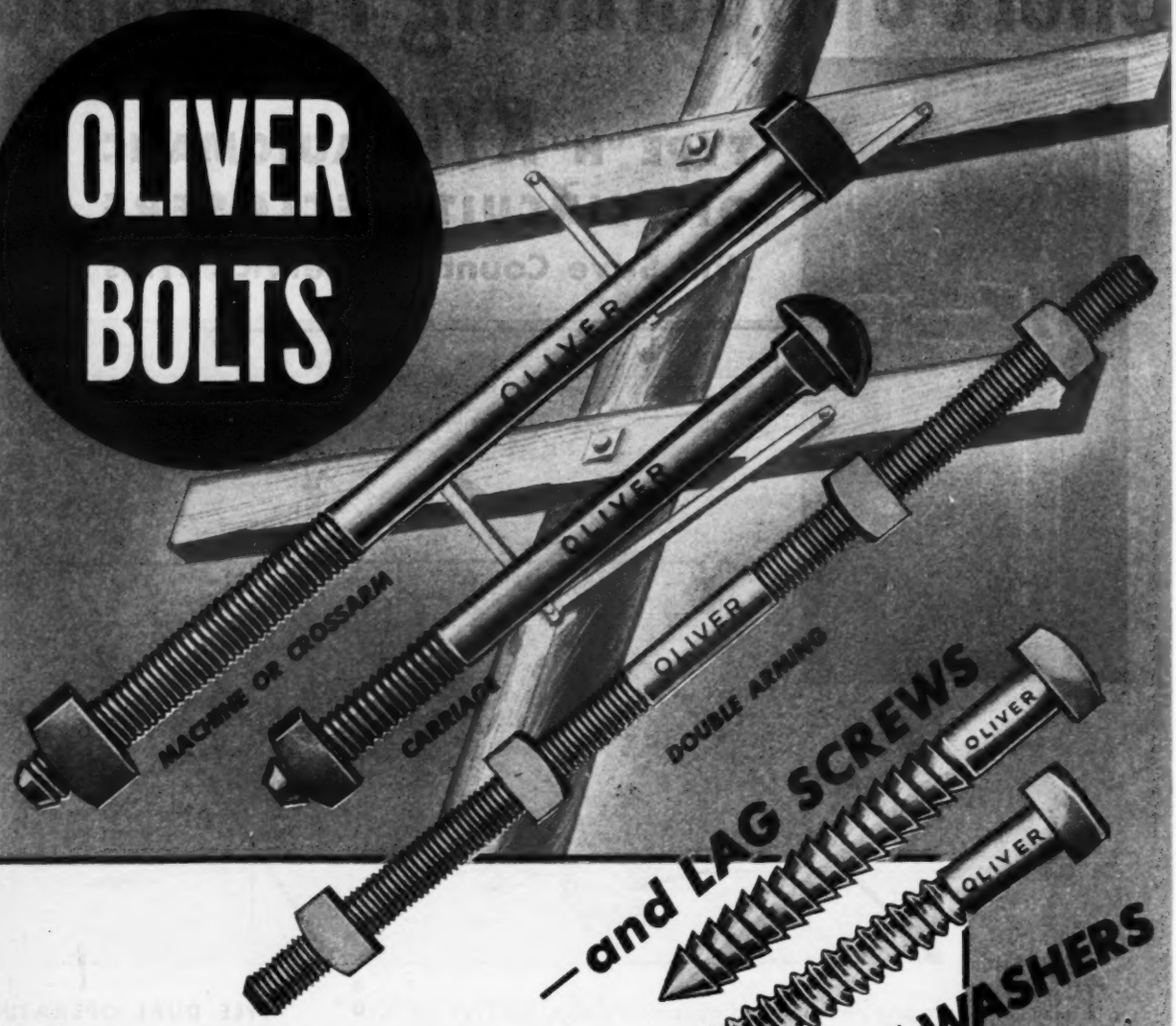
TRUCK TRAILERS AND BODIES • EARTH BORING MACHINES • WINCHES • OTHER PUBLIC UTILITY EQUIPMENT

General Offices

EDGERTON, WIS., U. S. A.

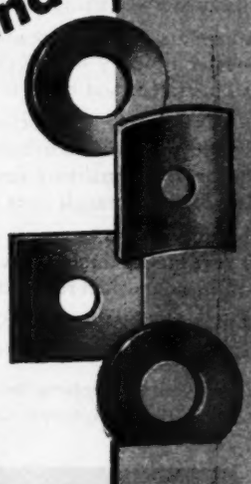
from the complete line of OLIVER POLE LINE MATERIALS...

OLIVER BOLTS



—and LAG SCREWS

—and WASHERS



Speed-pointed Oliver Bolts are made from new open-hearth steel. Heads are of proper size to develop full strength of bolts; threads are accurately rolled to uniform size and depth; galvanized coating is applied by a centrifugal process which removes excess spelter and insures free-running threads.

The Oliver line of bolts is complete in diameters and lengths. Lag Screws and Washers also available in popular sizes and styles.

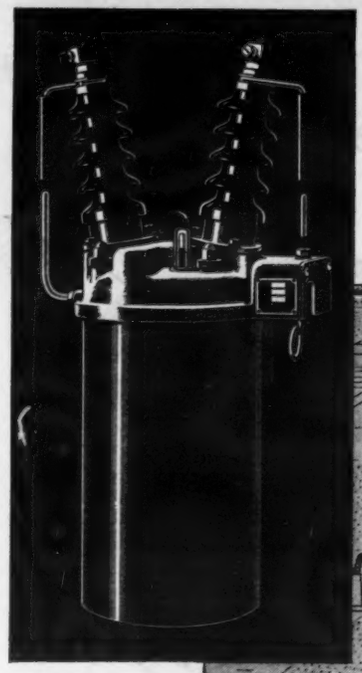
The Oliver Speed Point makes threading-on of nuts faster, protects end threads when driving out for salvage.

OLIVER
IRON AND STEEL
CORPORATION

SOUTH TENTH AND MURIEL STREETS · PITTSBURGH 3, PENNA.

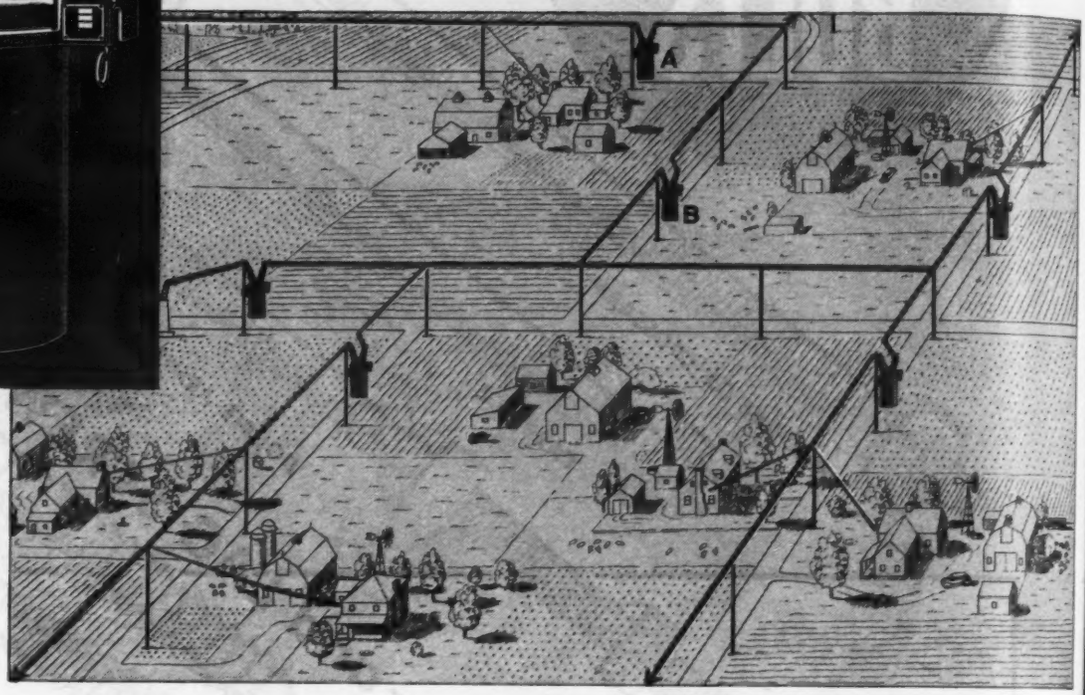
Makers of Pole Line Materials Since 1894

Short of Operating Personnel?



TYPE "H" *KYLE* AUTOMATIC OIL CIRCUIT RECLOSERS

Will Save Countless Service Trips



Today, with operating personnel and equipment scarce, the Type "H" Kyle Automatic Oil Circuit Reclosers provide a most effective means of keeping lines in service with a minimum of maintenance attention.

Where a system is spread over a wide area it is often desirable to protect the lines completely with Kyle Circuit Reclosers. These may be placed in series, as illustrated, and rated so as to coördinate with each other.

In this example, the Recloser at "A" will coördinate with the Recloser at "B". This in turn will coördinate with other Reclosers in the field and at the substation. Sectionalizing fuses may also be used beyond each Recloser for isolation of short branch lines where desired.

Use of Kyle Reclosers on your lines automatically gives you greater continuity of revenue-producing service than you have ever experienced . . . gives this to you in a day when reduced manpower and equipment are a serious problem.

Only a Kyle Automatic Oil Circuit Recloser will give you the advantages of dual operating characteristics.

Ask your Line Material Representative for full information on how to use Type "H" Kyle Automatic Oil Circuit Reclosers most profitably on your lines.

KYLE DUAL OPERATING CHARACTERISTICS GIVE

1 *Fast Opening*

. . . on First and Second Operations. This protects fuse links, restores service automatically after all temporary faults.

2 *Time Delay Opening*

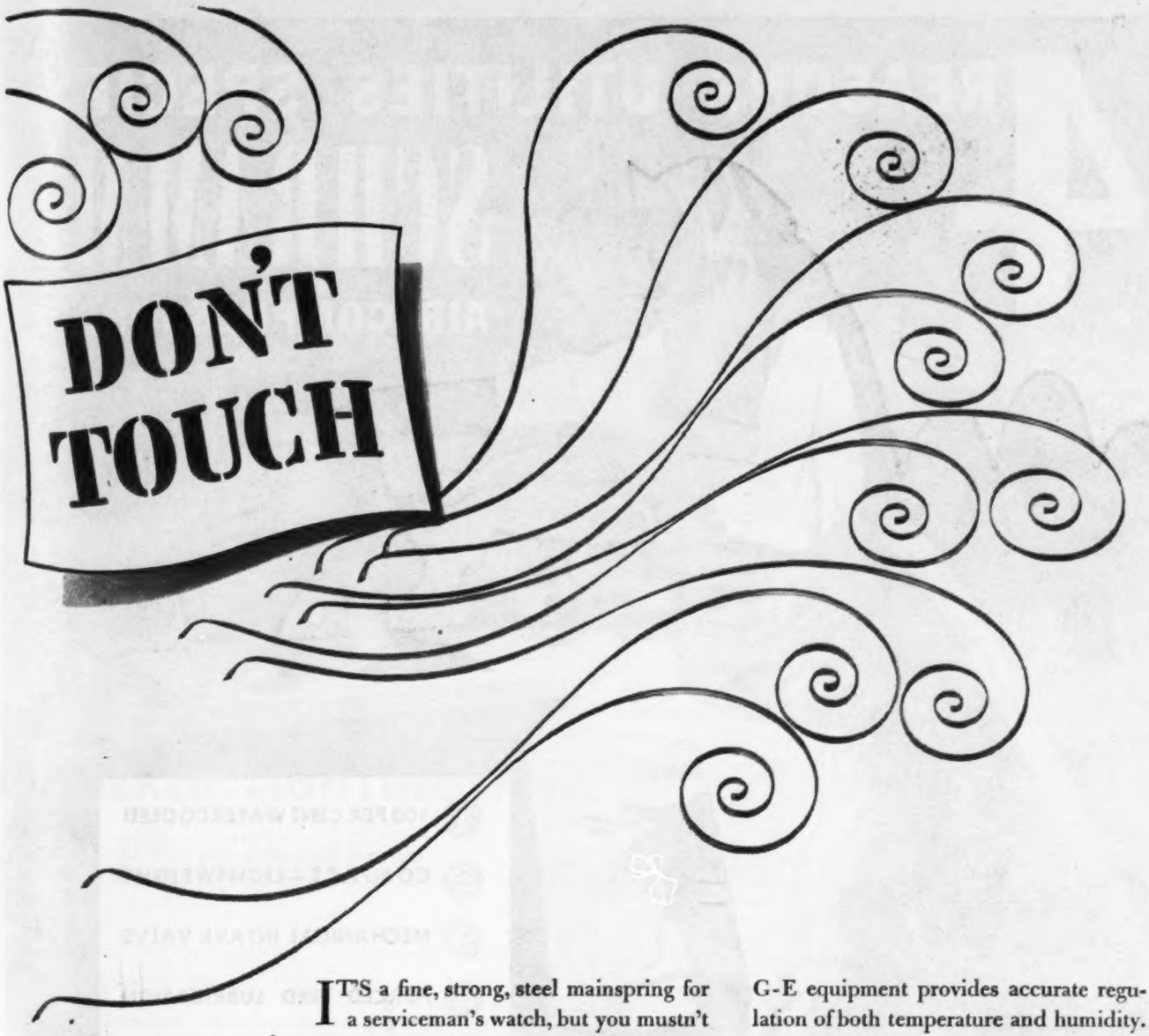
. . . on Third and Fourth Operations. This permits fuse links to blow, confines outages to smallest possible area.

Ratings of Type "H" Kyle Automatic Oil Circuit Reclosers

Volts: 2400 to 15,000 **Amperes: 5 to 50**
Tripping Current: 10 to 100 Amperes
Interrupting Current: 150 to 1200 Amperes

Recloser ratings are easily changed by substituting a coil of desired rating.

MADE BY KYLE CORPORATION



IT'S a fine, strong, steel mainspring for a serviceman's watch, but you mustn't touch—not if your fingers are moist with perspiration.

Because, as one war plant discovered, corrosion moves in where the finger has left its mark. Rejections were running high. Production schedules were threatened. And then General Electric Air Conditioning came to the rescue.

Installed in the assembly room, Air Conditioning kept workers' hands cool and dry—winter and summer. Because G-E equipment provides accurate regulation of both temperature and humidity.

Out of our rich and varied experience in helping war industries solve their problems, will come more compact, more efficient, more economical air conditioning and industrial refrigeration after victory. Would you like to be among the first to get all the facts on postwar equipment—when available? Write:

General Electric Company, Air Conditioning and Commercial Refrigeration Divisions, Section 5194, Bloomfield, New Jersey.

Advertisements like this, appearing monthly in magazines read by leading industrialists, help you to build ever increasing loads.

GENERAL ELECTRIC

Air Conditioning

BUY and hold WAR BONDS

Tune in: The "G-E HOUSE PARTY" every afternoon Monday through Friday, 4 p. m., E W T, C B S . . . The "G-E ALL-GIRL ORCHESTRA," Sundays, 10 P. M., E W T, N B C . . . "THE WORLD TODAY" News, Monday through Friday, 6:45 P. M., E W T, C B S

4 REASONS UTILITIES SPECIFY SCHRAMM AIR COMPRESSORS

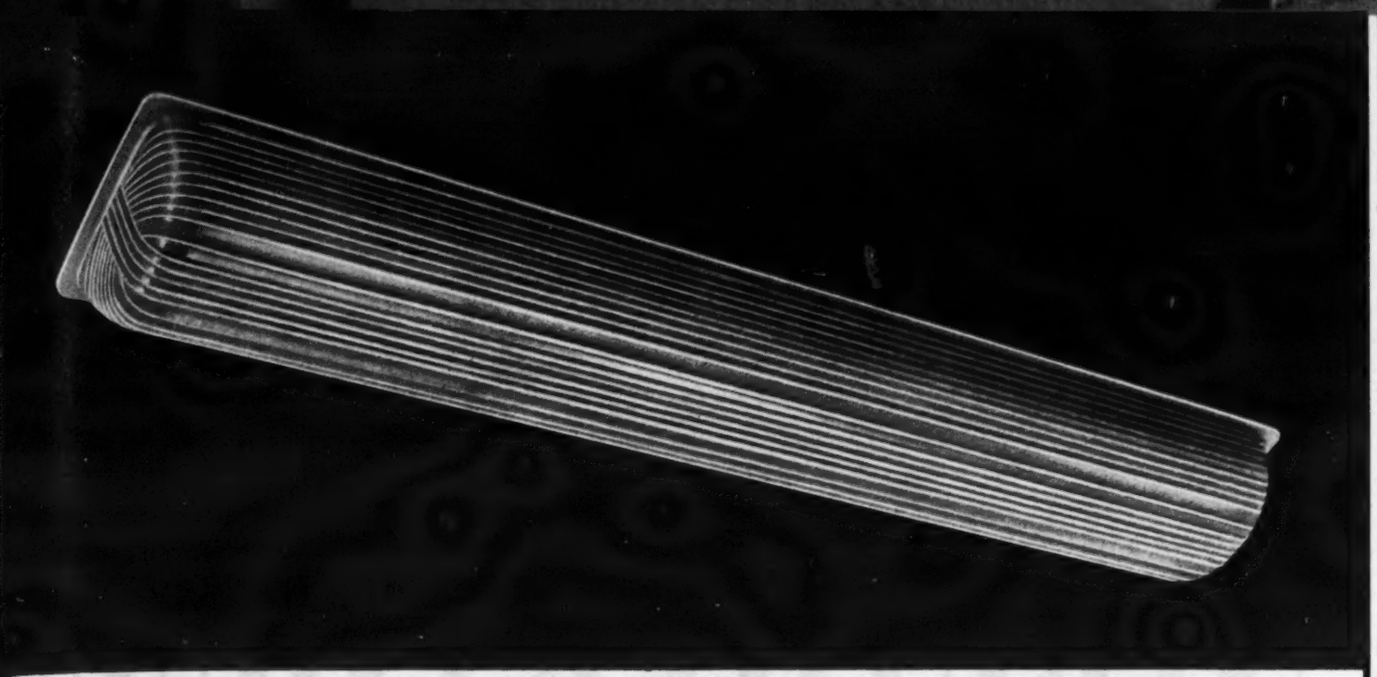
There are many compressed air jobs to be done by Utility Companies, and into this versatile picture fits the Schramm Air Compressor. Its features enable compressed air jobs to be done quickly—easily—economically!

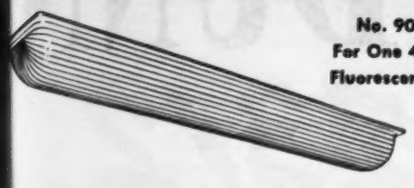
Illustrated here is a sandblasting job, one of many applications for Schramm Compressors. They are designed for heavy duty, continuous service, with minimum attention.

Schramms are built in sizes ranging from 20 to 600 cu. ft. displacement in every type of mounting and assembly. Start your compressor planning by writing for detailed literature and features of Schramm Compressors, both stationary and portable.

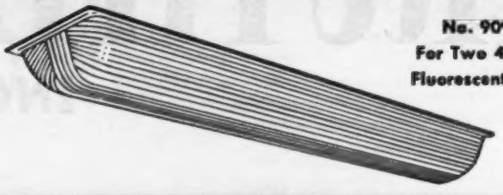
SCHRAMM INC.

THE COMPRESSOR PEOPLE
WEST CHESTER
PENNSYLVANIA





No. 90960
For One 40 watt
Fluorescent lamp



No. 90961
For Two 40 watt
Fluorescent lamps

NGINEERED LIGHTINGWARE BY CORNING MEANS
etter illumination . . . improved appearance

e is a fluorescent diffusing shield . . . the only one of its kind . . . with closed . . . **ALL IN ONE PIECE** . . . scientifically designed to meet the exacting irements of architect, illuminating engineer and fixture designer.

lade of "Alba," a homogeneous translucent glass of medium diffusion and transmission, these shields diffuse the light rays over a wide area with brightness levels. Harsh direct light and glare in the line of vision are inated. The shields shown are made for use with one and two fluores- lamps to provide required illumination.

he uniform quality of the glass and the smooth contour of the shield gn present a pleasing, modern appearance. There are no dark, opaque . These shields are designed with a continuous flanged edge to permit ed frame mounting . . . to make cleaning and lamp replacement le operations.

r more information about Corning Engineered Lightingware and it means to you, write today for your copy of "Corning Light- Data"—Lighting Sales Dept. EW-4 Corning Glass Works, ing, New York.

Whatever Your Lighting Problems . . .
Specify Corning Engineered Lightingware

CORNING LENSES AND PANELS
Are Available for
GENERAL LIGHTING
SUPPLEMENTARY LIGHTING
LOCALIZED LIGHTING

For Special Effects in
Commercial Interior Lighting
STORES SCHOOLS
THEATRES MUSEUMS
BANKS HOTELS
OFFICES HOSPITALS

Recommended for Industrial
Plant Lighting, General Illumination
and Localized Lighting
INDUSTRIAL PLANTS PRIVATE AND
ASSEMBLY LINES GENERAL OFFICES
INSPECTION AREAS ELECTRICAL
LABORATORIES INSTRUMENT
DRAFTING ROOMS PANEL BOARDS

NING" and "ALBA" are registered trade-marks and indicate manufacture by Corning Glass Works, Corning, N. Y.

NING
ons
in Glass

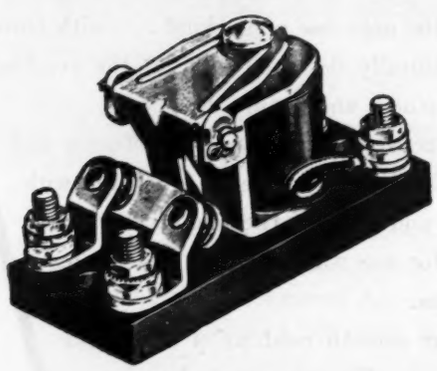
Corning Engineered Lightingware
BRAND

STRUTHERS-DUNN

INC.

~~5,288~~ 5,312

TYPES OF



RELAYS

Each available in countless coil combinations

1321 ARCH STREET, PHILADELPHIA 7, PA.

for low operating and maintenance cost on RURAL LINES...use Wagner Self-Protected Transformers

The use of Wagner type HEBF-P Self-Protected Rural-Line Transformers assures important savings in operation and maintenance because of their improved design, high-quality construction, ease of installation, and high efficiency.

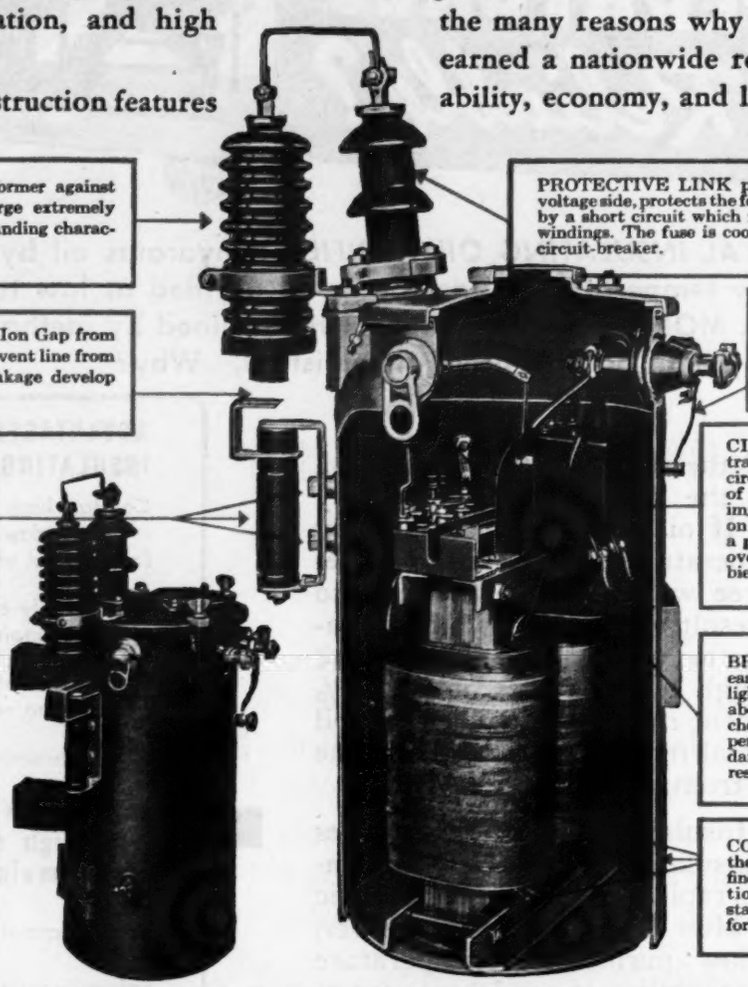
Many design and construction features contribute to the excellent reputation of Wagner Protected type transformers—too many to list in the space limitations of this advertising message. The features listed below are but a few of the many reasons why the type HEBF-P has earned a nationwide reputation for dependability, economy, and long life.

DE-ION GAP protects transformer against surges. The ability to discharge extremely high surge-currents is its outstanding characteristic.

ISOLATING GAP isolates De-Ion Gap from the ground series-resistor to prevent line from being grounded should any leakage develop in the De-Ion Gap.

SERIES-RESISTOR is furnished in order to limit the power-current (follow-current) which may flow after a surge has occurred. Double-mounting of the series-resistor assures correct location and spacing of the isolating gap.

Direct pole mounting brackets have standardized spacing for easy interchangeability. One or two mounting positions are available.



PROTECTIVE LINK placed in series with the high-voltage side, protects the feeder against line lockout caused by a short circuit which might occur in the transformer windings. The fuse is coordinated with the low-voltage circuit-breaker.

GROUND-STRAP grounds neutral low-voltage bushing externally to the tank. Tank is provided with solderless ground-connector.

CIRCUIT-BREAKER protects transformer from secondary short-circuits and over-loads. It consists of a switch thermally-operated—immediately in case of short circuit on the consumer circuit, and after a predetermined time interval for over-loads. Compensation for ambient temperature is automatic.

BREAKER RESET HANDLE is easily accessible. A warning signal-light, furnished on 5-kva sizes and above, serves as an automatic load check to give warning when temperature of windings reaches a dangerous level. It is built into the reset handle.

CORE AND COILS, as well as the TANK, embody the latest refinements in design and construction, and meet all recognized standards for distribution transformers.

TRANSFORMERS
are but one of several WAGNER PRODUCTS serving industry.

Other WAGNER PRODUCTS:
AIR BRAKES
•
BRAKE LINING
•
HYDRAULIC BRAKES
•
INDUSTRIAL BRAKES
•
INDUSTRIAL BRAKE CONTROLS
•
TACHOGRAPH (Recording Speedometer)
•
ELECTRIC MOTORS

THESE 29 SALES AND SERVICE BRANCHES ARE READY TO SERVE YOU

For complete information on Wagner Self-Protected Rural-Line Transformers (or other types of Wagner transformers such as distribution, power, air-cooled, substation, etc.) write to the address below or to the nearest of these 29 branches manned by trained field engineers who are ready to help you solve your transformer problems:

ATLANTA 3 • BALTIMORE 18 • BOSTON 15 • BUFFALO 8 • CHICAGO 16 • CINCINNATI 10
CLEVELAND 15 • DALLAS 1 • DENVER 2 • DETROIT 2 • HOUSTON 2 • INDIANAPOLIS 4
KANSAS CITY 8 • LOS ANGELES 15 • MEMPHIS 3 • MILWAUKEE 2 • MINNEAPOLIS 4
NEW YORK 7 • OMAHA 2 • PHILADELPHIA 8 • PITTSBURGH 13 • PORTLAND 9 • ST. LOUIS 3
SALT LAKE CITY 1 • SAN FRANCISCO 3 • SEATTLE 4 • SYRACUSE 2 • TULSA 3 • WASHINGTON 5

T45-B

Wagner Electric Corporation

ESTABLISHED 1891
6456 Plymouth Avenue, St. Louis 14, Mo., U. S. A.
ELECTRICAL AND AUTOMOTIVE PRODUCTS

Why is INSULATING OIL PURIFIED AT LOW TEMPERATURES *More Reliable?*

THE DE LAVAL INSULATING OIL PURIFIER **dehydrates oil by centrifugal force, at low temperatures. Insulating oil purified at low temperatures is *SAFER . . . MORE RELIABLE* than that maintained by methods demanding relatively high heat to drive off moisture. Why?**

BECAUSE- the solubility of water in oil increases with the temperature, especially above 112° F. If oil is heated considerably above this temperature before water is removed, some free water will be driven into solution. The result will be that while a relatively high dielectric test may be obtained for oil purified at high temperatures, up to 50% of the improvement may be lost when the oil is cooled to normal temperature, releasing the dissolved water from solution.

The De Laval Insulating Oil Purifier removes moisture from insulating oil at low temperature, preventing rapid reduction in dielectric strength of oil after purification. Moreover, the relatively low purification temperature eliminates the probability of condensate forming in receiving tanks.

The electric heaters, of low temperature heat transfer type, prevent carbonization of the oil and keep heating costs down to a minimum.

- Send for additional details.

ADVANTAGES OF DE LAVAL INSULATING OIL PURIFIERS

Constant high purifying efficiency —no shutdowns for cleaning or for renewal of parts during run

•

Higher daily capacity of purifier saves maintenance costs

•

Dehydrates at a single pass— no re-running

•

More economical to operate

•

Low temperature purification; high dielectric value of oil maintained longer

•

Heater cannot carbonize the oil

•

Safest—continuous discharge of water prevents re-contamination of the insulating oil

•

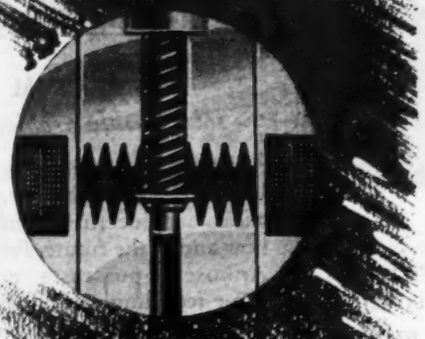
Removes water without aid of filter press; press used only to remove colloidal carbon

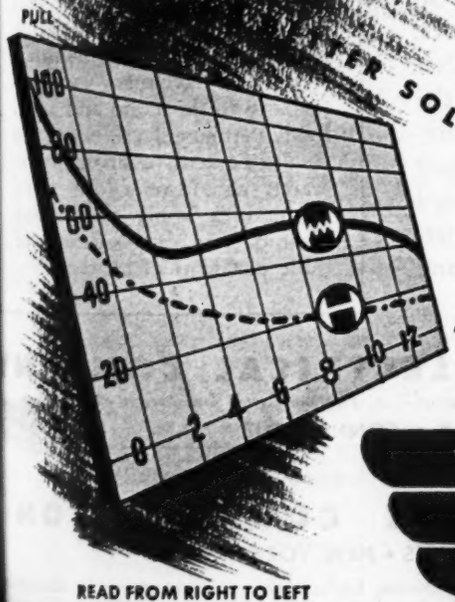
DE LAVAL

INSULATING OIL PURIFIERS

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19
THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

PERSONS SOLENOIDS ARE *Quick* ON THE TRIGGER





NEW "TOOTH" CONSTRUCTION RESULTS IN GREATER STARTING POWER

(U.S. Patent Pending)

Solenoids—like gun triggers—require greatest pull at the start. But ordinary solenoids develop it at the end. Not so Persons'. Their "teeth" on plug and plunger reduce the air gap and its inertia so that a given job can be done by a lighter, more compact solenoid—with peak pull at the start.

Many models AVAILABLE IMMEDIATELY. Send for our bulletin.

TER SOLENOIDS WE ARE THE "PERSONS" TO SEE

MP SOLENOIDS CORPORATION

6309 MANCHESTER AVE. • ST. LOUIS 10, MO.

The Television Dream That Cables Make Possible

TELEVISION—sign and symbol of the age to come—is one of the wonders that specially designed cable transmission makes practical. For the quality and fidelity of the transmitted image depend largely on how well the cables are engineered and manufactured, from tiny cables in the broadcasting mechanism itself to the great coaxial cables linking city with city, making possible the television networks of the future.

Thus the "wireless age" as it develops will actually need more wires—and more complicated cables—to achieve its realization! And in the solution of these problems, new and more complicated cables will be required.

Today, we will undertake to engineer and manufacture the radio and audio cable requirements of any government agency or private concern in war work. Moreover, we look forward to solving many of the most difficult cable tasks in peacetime—as we have in wartime. The same laboratories, the same Yankee ingenuity that have helped to whip many of the difficulties involved in the communications requirements of our Army and Navy are prepared to function for industry—whatever the problems of today and tomorrow.

Why ANKOSEAL *solves cable problems*

Ankoseal, a thermoplastic insulation, can help solve many electrical engineering problems, now and in the future. *Polyvinyl* Ankoseal possesses notable flame-retarding and oil resisting characteristics; is highly resistant to acids, alkalies, sunlight, moisture, and most solvents. Polyethylene Ankoseal is outstanding for its low dielectric loss in high-frequency transmission. Both have many uses, particularly in the radio and audio fields. Ankoseal cables are the result of extensive laboratory research at Ansonia—the same laboratories apply engineering technique in the solution of cable problems of all types.

THE ANSONIA ELECTRICAL COMPANY

Specializing in "Ankoseal" a Thermoplastic Insulation

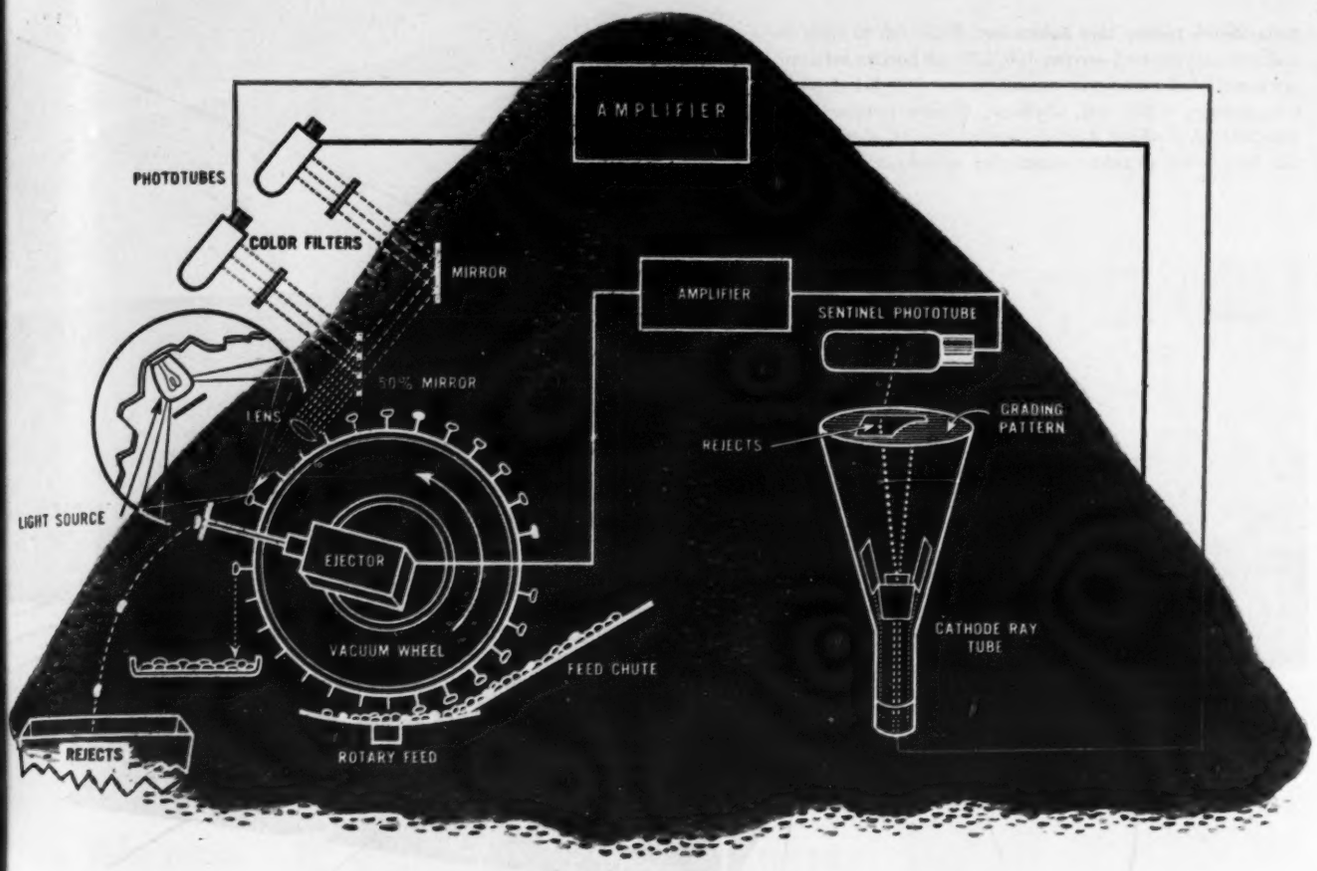
ANSONIA • CONNECTICUT

A Wholly-Owned Subsidiary of

NOMA ELECTRIC CORPORATION

GENERAL OFFICES • NEW YORK, N. Y.

—In peacetime makers of the famous Noma Lights—the greatest name in decorative lighting. Now, manufacturers of fixed mica dielectric capacitors and other radio, radar and electronic equipment.



How to sort a mountain of beans with RCA Electron Tubes

New Electronic device by Electric Sorting-Machine Co. color-sorts beans, corn, peanuts, coffee, and similar products — faster, better, more economically

AN electronic sorting-machine, developed by Electric Sorting-Machine Company, provides a fast, accurate method of color-sorting. In use throughout the country, this device is saving manpower and money and is speeding vital food-processing. Its ingenious principle is readily adaptable to a multitude of sorting problems.

How It Works: As each bean goes through the machine, it is illuminated by an incandescent lamp. Light reflected from the bean is picked up by two RCA phototubes, one sensitive to red light, the other, to green. The percentage of red and green light reflected from the bean determines its acceptance or rejection.

The output of each phototube is fed into dual-channel amplifiers and from there to opposite deflection electrodes of an RCA cathode-ray tube. The cathode-ray beam is deflected vertically and horizontally in proportion to percentage of red and green light picked up by phototubes.

A mask covers one area of the cathode-ray tube screen. The beam falls in this area when the percentage of red and green is acceptable. When the beam falls on the unmasked area of the screen, it means that the color is *not* acceptable. A "sentinel" phototube picks up the "off-color" signal and actuates a relay which rejects the faulty bean.

Turn to Electronics for Solution of Your Own Problems: For information on this equipment, write to Electric Sorting-Machine Company, Grand Rapids, Michigan.

Electron tubes are providing a practical solution to hundreds of diversified manufacturing problems—process-control, machine-control, heat-treating, plant-protection, and a host of others. Consult with RCA tube-application engineers for information or advice on use of electron tubes in the design of your own equipment. For examples of electronics at work in our own factories, send for the free booklet "Electrons in Action at RCA." Write to RCA, Commercial Engineering Section, Dept. 62-54W, Harrison, New Jersey.

THE FOUNTAIN-HEAD OF MODERN TUBE DEVELOPMENT IS RCA

BUY BONDS BUY BONDS BUY BONDS BUY BONDS

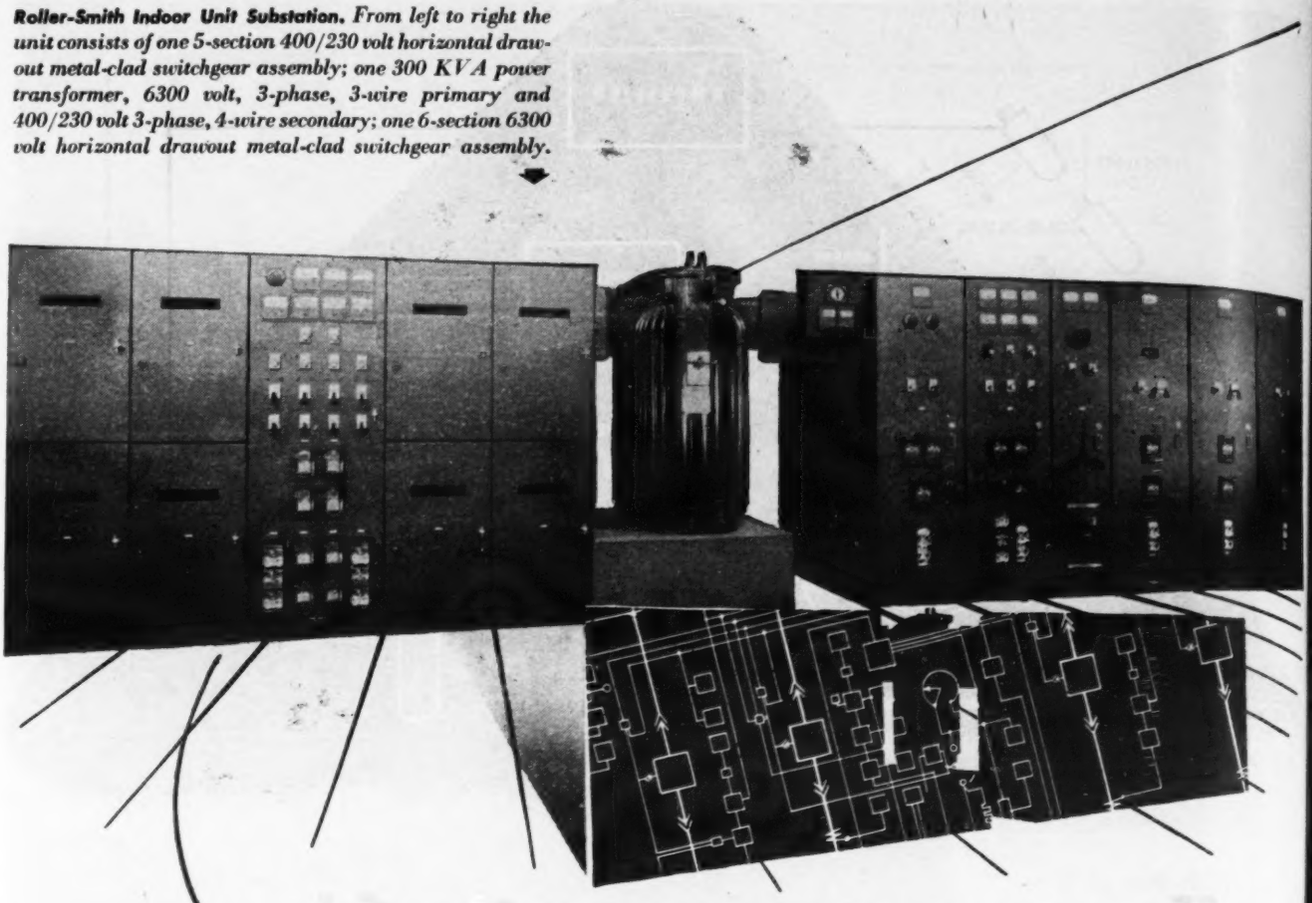
RCA

62-6336-34

RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION, CAMDEN, N. J.

Roller-Smith Indoor Unit Substation. *From left to right the unit consists of one 5-section 400/230 volt horizontal draw-out metal-clad switchgear assembly; one 300 KVA power transformer, 6300 volt, 3-phase, 3-wire primary and 400/230 volt 3-phase, 4-wire secondary; one 6-section 6300 volt horizontal drawout metal-clad switchgear assembly.*



Indoor Unit Substations to your Unit Requirements by Roller-Smith

By selecting Roller-Smith Metal-Clad Switchgear you will have a completely co-ordinated unit, designed and built to your individual requirements. Assembled and factory-tested before shipment, it is delivered to your location requiring only the necessary service connections.

The advantages of the unit substation are many. It can be placed near or at load centers, effecting marked savings in the amount of copper required for secondary runs and minimizing voltage drop. The unit can be expanded or moved to another location if changing conditions require it.

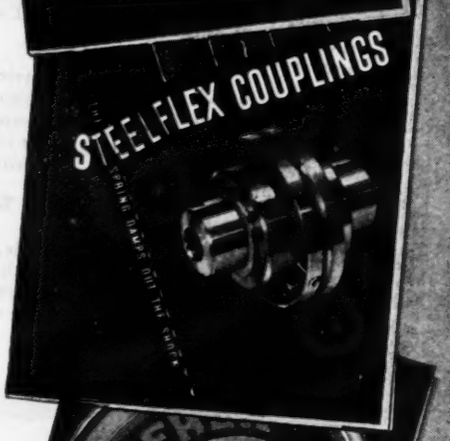
Before specifying any type of switchgear it will pay you to become acquainted with what Roller-Smith can offer. Send us an outline of your power distribution problem and we will furnish complete information.

ROLLER SMITH

Sales Representatives In all Principal Cities

STANDARD AND PRECISION ELECTRICAL INSTRUMENTS • AIRCRAFT INSTRUMENTS • SWITCHGEAR • AIR AND OIL CIRCUIT BREAKERS • ROTARY SWITCHES • RELAYS • PRECISION BALANCES

The bulletins shown are typical of the engineering service Falk renders to industry.



The Phrase FALK ... A GOOD NAME IN INDUSTRY Possesses Tangible Values For You!

The individual sale of a product is incidental. The service which that product renders is all-important . . . All-important to the buyer, because the continued satisfactory performance of that product confirms his judgment in purchasing it . . . All-important to the seller, because the satisfaction rendered the buyer enables the manufacturer to make sale after sale.

Falk products have been rendering a satisfactory service to industry for over 50 years. It is this satisfactory service that has enabled The Falk Corporation to continue, and to progress. It has enabled the buyer to depend on Falk claims for its products, and to depend on the performance to be secured from those products.

This is what we imply when we say: "Falk . . . a Good Name in Industry." That phrase includes the Falk philosophy of doing business, its policies, its research, its engineering skills, its production facilities, its service to industry, to its community, and to its employes. All this has given the Falk name a tangible value; and this tangible value has been meticulously maintained.

You who buy Falk products have acclaimed Falk a good name in industry. The fact that you were jointly responsible for this good name automatically provides you with values that would not otherwise be available.

Therefore we say "Falk . . . a Good Name in Industry" possesses concrete value, and carries the assurance that "it always pays to consult Falk."

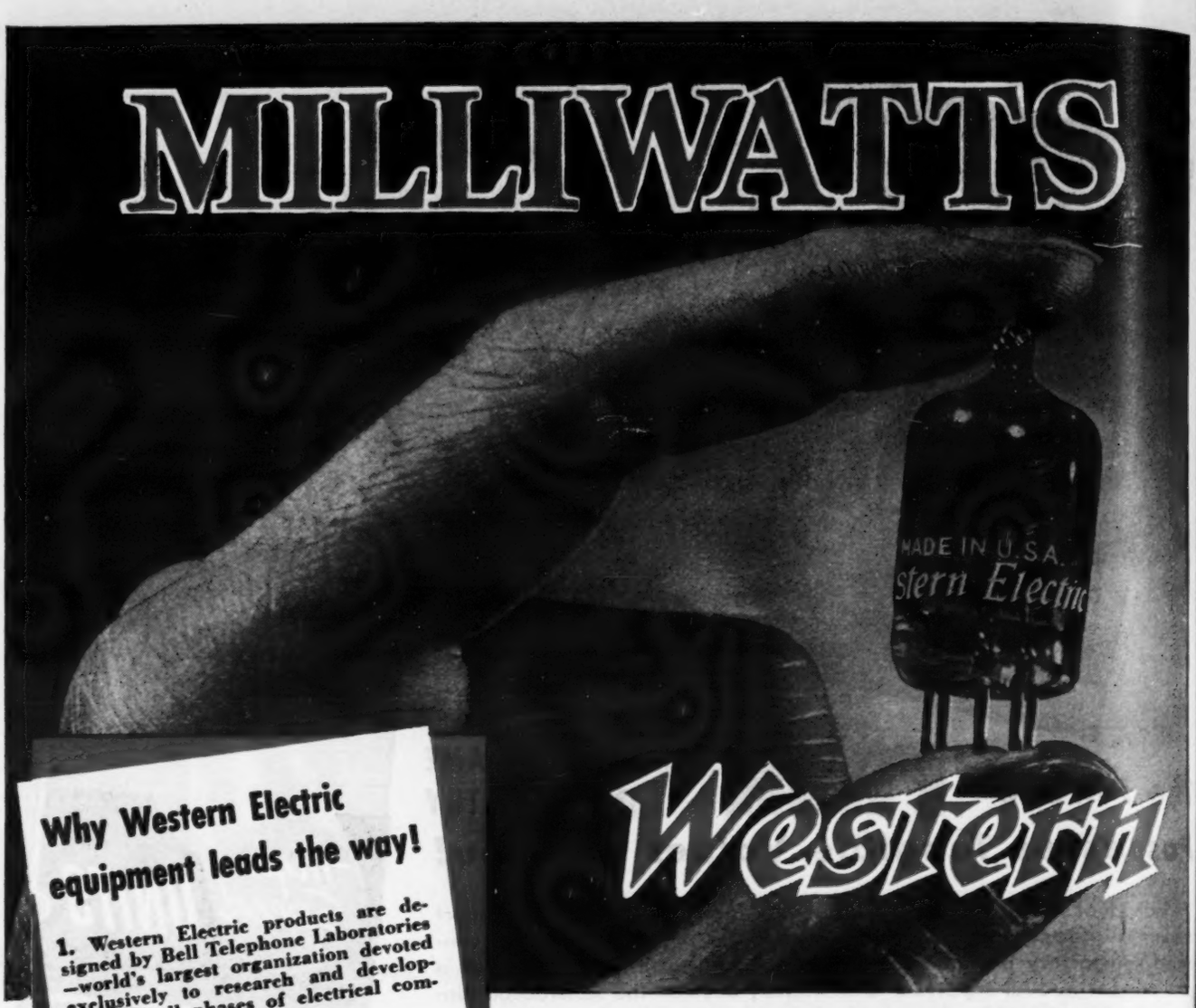
THE FALK CORPORATION, MILWAUKEE 8 WISCONSIN

ALWAYS PAYS TO CONSULT **FALK** . . . A GOOD NAME IN INDUSTRY

For over fifty years Precision Manufacturers of
Speed Reducers • Motoreducers • Flexible Couplings • Herringbone and Single Helical Gears • Heavy Gear Drives
Marine and Diesel Engine Gear Drives and Clutches • Steel Castings • Contract Welding and Machine Work.

District offices, representatives, or distributors in principal cities.

MILLIWATTS



Western

Why Western Electric equipment leads the way!

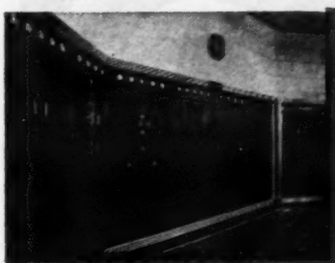
1. Western Electric products are designed by Bell Telephone Laboratories—world's largest organization devoted exclusively to research and development in all phases of electrical communication.

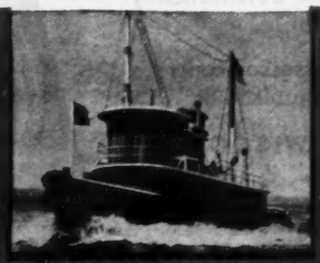
2. Since 1869, Western Electric has been the leading maker of communications apparatus. Today this company is the nation's largest producer of electronic and communications equipment.

3. The outstanding quality of Western Electric equipment is being proved daily on land, at sea, in the air, under every extreme of climate. No other company has supplied so much equipment of so many different kinds for military communications.

From tiny tubes to eight foot water cooled giants—from vest pocket aids for the hard of hearing to super-powered radio transmitters—Western Electric has led the way in electrical communications equipment for many years.

Western Electric vacuum tubes for over 30 years have been noted for their uniformity and long life. Scores of new and radically different


BROADCASTING


MARINE RADIO

AVIATION RADIO

MOBILE RADIO

Western Electric has specialized

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Electric
equipment leads the way!

types of tubes have been introduced by Western Electric and Bell Telephone Laboratories for war services. These new tubes — and the techniques used in developing and manufacturing them — will find many important uses in communications at the war's end.

In all forms of electrical communications, count on Western Electric for continuing leadership.

Western Electric

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Buy all the War Bonds you can . . . and keep all you buy!

SOUND SYSTEMS

TELEVISION

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knowledge in all of these fields

DOLLAR-VALUE
SAVINGS FOR A UTILITY

Here are some of the annually recurring savings for a Utility which habitually buys its electrical material and supplies from a Thomas & Betts Electrical Wholesaler.

The T&B Electrical Wholesaler stocks and delivers electrical shelf goods and other supplies, thereby releasing more storeroom space and more working capital for more profitable uses.

He makes job-site delivery—to roadside depots, construction gangs—reducing overhead, storeroom percentage and carting costs.

He reduces bookkeeping work and man-hours spent in handling, assorting and stocking material.

He insures delivery to storeroom or job and assumes all responsibility for damaged goods or claims for lost goods.

He sells a profitable volume of electrical appliances in normal times, thus building the Utility load.

He minimizes risks of interrupted service in homes by supplying the local electricians with their essential maintenance and repair products.

ANNUAL VALUE OF THIS SERVICE TO A UTILITY	FOR WHICH A UTILITY PAYS:
$_____	$ 0
$_____	$ 0
$_____	$ 0
$_____	$ 0
$_____	$ 0
$_____	$ 0

Wholesaler Distribution of electrical products is economically sound. It saves money and time for the Utilities. It reduces the manufacturer's selling costs thereby reducing the cost of all electrical products to the user. Under the T&B Plan all T&B products are sold exclusively through the competent service organizations of T&B Distributors.

THE THOMAS & BETTS COMPANY HAS DISTRICT OFFICES* LOCATED AT:

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T&B

THE THOMAS & BETTS CO.
INCORPORATED
manufacturers of electrical fittings since 1898
ELIZABETH, 1, NEW JERSEY
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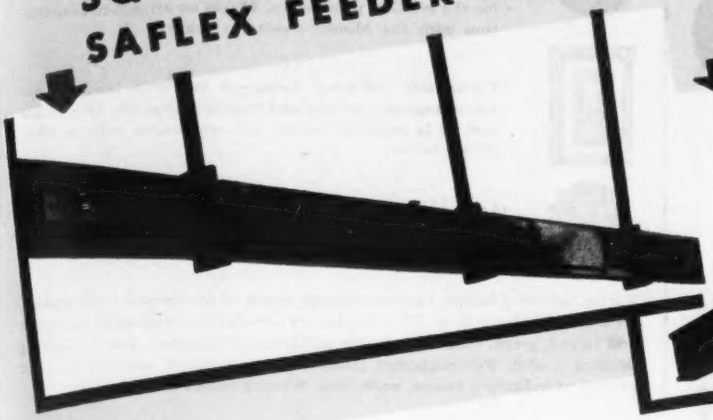
FOR EFFICIENT POWER DISTRIBUTION

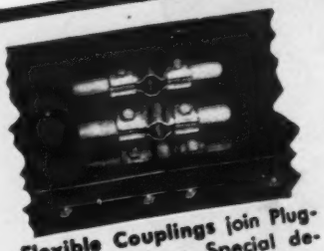
SQUARE D SAFLEX FEEDER DUCT



SQUARE D SAFLEX PLUG-IN DUCT

Square D Saflex Feeder Duct is designed to serve as the feeder between transformer banks and main switchboard or as feeders to branch circuits where minimum voltage loss is essential. Because of its low reactance and consequent balanced low voltage drop (1.8 volts per 100 feet) it is ideally suited for welder circuits —enables conductor size to be kept at a minimum. Feeder duct is available in standard 10-foot sections with special fittings to meet all types of installations. WPB sizes of 800, 1000, 1350 and 2000 ampere capacities.

Square D Plug-In Duct is a perfect running mate for Feeder Duct. It permits plugging-in machines whenever and wherever they are needed. Units are easily attached and disconnected. 100% salvage for re-use. Available in 250, 400 and 600 ampere capacities.

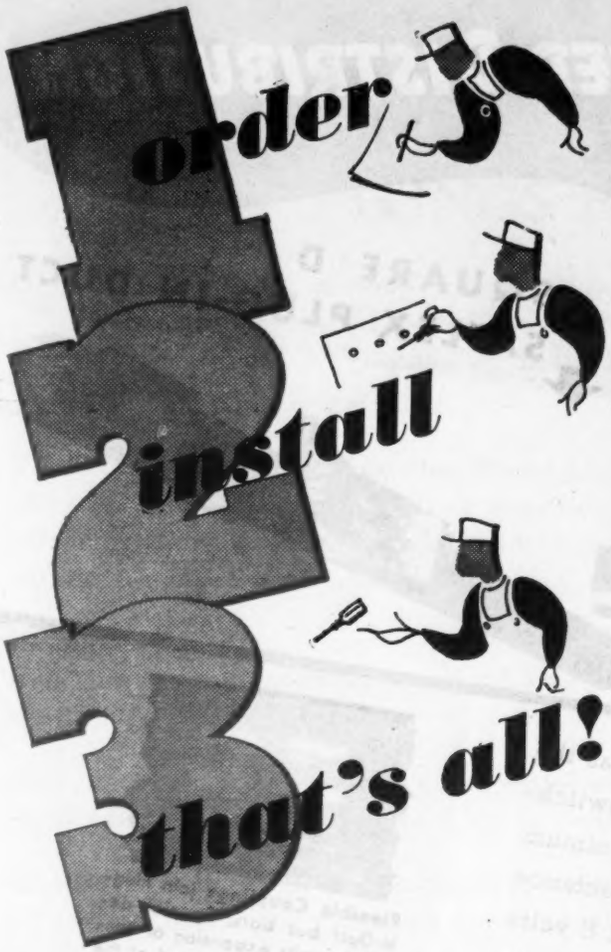


Flexible Couplings join Plug-In-Duct bus bars. Special design permits expansion or contraction to be absorbed at the joint, and also provides flexible connections for correction of minor variations in bus alignment. Notice use of round tubular buses which afford highest possible mechanical strength when subjected to heavy short circuit stresses.

Units Easy to Attach. Hook-type bracket on top of plug-in unit attaches to top of duct. Unit is then swung down and jaws snap into position on bus bars—tightened securely with a single screw—on or off in a jiffy. 10 units may be attached to each 10′ section.

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES



Whether you want one or 1,000 of these control details, Westinghouse can furnish them within a reasonable time. They arrive as complete units, ready for assembly into your switchboard.

These are the *same* circuit details which Westinghouse has thoroughly time-tested in its own apparatus.

Thus, you are assured the latest design.

Other devices available include pushbuttons, knife switches, test switches, card holders, terminals. For more information, write your Westinghouse office. Westinghouse Electric & Mfg. Co., P.O. Box 868, Pittsburgh 30, Penna.

J-60598

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

SWITCHBOARD DETAILS

THESE FAMILIAR WESTINGHOUSE SERVICE DETAILS...SAVE TIME IN BUILDING SWITCHBOARDS

INDICATING LAMPS

Round Minalite—A medium-drain lamp especially suited for miniature steel panels . . . gives maximum illumination for the smallest panel space. Makes an attractive combination with the Minatrol switches below.

Rectangular Indicating Lamp—A low-drain lamp for extreme angular visibility and compact mounting. Of medium size, it is especially suited for installation with switches shown below.

Large Indicating Light—Provides high illumination and can be universally mounted. Has comparatively high drain but gives maximum visibility at greater distances.

These indicating lamps, for mounting on panels up to 2 inches thick, operate on a-c or d-c, from 25 to 250 volts. Lenses are available in clear or opalescent and in red, green, blue, amber. For additional information, ask for Catalog Section 37-200. For suggested panel drilling layout of switches and for groups of indicating lamps, write your Westinghouse office.

CONTROL SWITCHES

Minatrol—A compact switch, with small dimensions, to save space on miniature panels. Has heavy-duty contacts which eliminate interposing relays in most circuits. Available for control, instruments, temperature indicators, etc.

Type W Switch—A standard heavy-duty control switch available in a variety of full-hand grips—removable, keyed type; pull-out lock type; automatic-return-to-neutral type; and stay-put types. Used for control, instruments, temperature indicating, etc.

Auxiliary Switch—Similar to Type W, except it is mechanically actuated by levers. Can be actuated by doors or moving mechanisms—and is commonly used for safety interlocks, sequence or process controls. Special mounting provisions and housings, including an outdoor type, are available.

For additional information on the Minatrol switches, ask your Westinghouse office for Catalog Section 37-175; for Type W and auxiliary switches, ask for Descriptive Data 37-150.

TERMINAL BLOCKS

8-circuit black terminal block with high-pressure connectors.

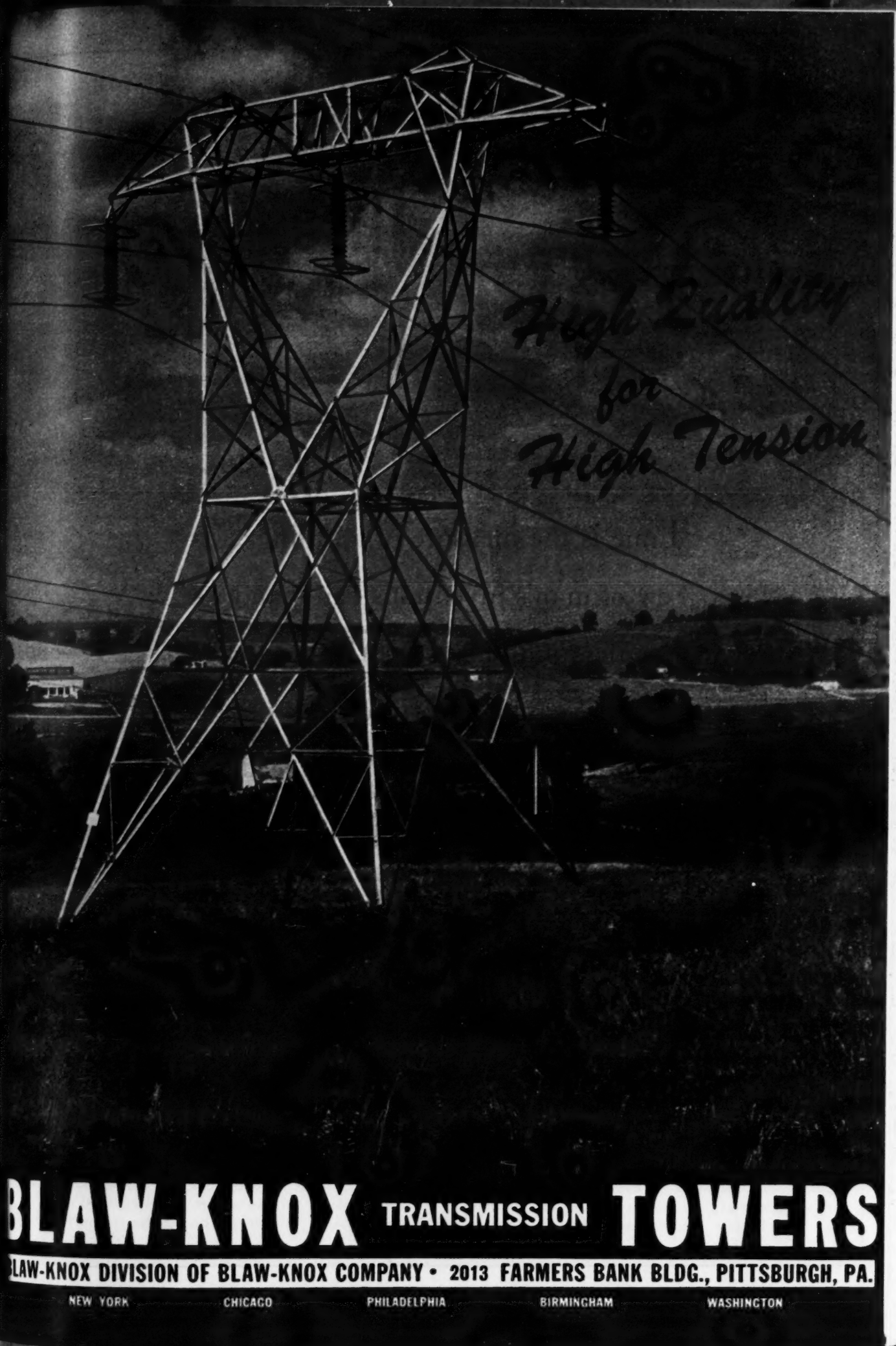
Cover partially removed, showing clamp type terminals on 8-circuit terminal block.

These terminals are used extensively in Westinghouse products and are available in a variety of molded bases, terminal constructions and number of terminals. The three commonly used combinations are:

1. 4, 5, 8 or 12 terminals per block—with captive standard or high-pressure terminals or hardware. This is a standard type board with black molded plastic base of high impact strength and very low moisture absorption.

2. This board is specified for Navy electronic equipment. Black molded plastic base has high impact strength, low moisture absorption and high fire resistance. Hardware includes binder head, screws and shakeproof washers.

3. This board is specified for Navy switchgear—has 4, 8 or 12 terminals, and standard hardware. Has black molded plastic base of high impact strength, low moisture absorption, and high fire resistance.



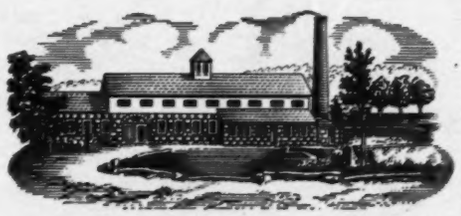
BLAW-KNOX TRANSMISSION TOWERS

BLAW-KNOX DIVISION OF BLAW-KNOX COMPANY • 2013 FARMERS BANK BLDG., PITTSBURGH, PA.

NEW YORK CHICAGO PHILADELPHIA BIRMINGHAM WASHINGTON

Time

Time is the measure of all things. Few of man's inventions can stand its merciless judgment. Yet Kerite for over 80 years has thrived and spread and gained renown. Time, indeed, gives Kerite its unqualified recommendation.

1854  1864

The Kerite Insulated Wire & Cable Company, Inc.

NEW YORK CHICAGO SAN FRANCISCO

PIONEERS IN CABLE ENGINEERING

AMERICA WANTS PROSPERITY

A BOOK to be published early in April by the McGraw-Hill Book Company carries the provocative title "Prosperity: We Can Have It If We Want It." Its authors, Messrs. Shields and Woodward, state in vigorously challenging terms their conviction that the United States will emerge from war with human, material and technological resources adequate to provide a nation-wide standard of living unprecedented in world history. They present, too, their formulation of the several policies and procedures which must be followed by government, business, and labor if we are to realize our potential for a high and sustained prosperity unmarred by prolonged periods of severe unemployment and business stagnation such as have haunted our economic past.

The specific proposals set forth will elicit both enthusiastic acclaim and acrid dissent, for the book deals in far from gentle fashion with many of the currently fashionable panaceas for assuring prosperity by magic formula. It examines, and discards as effective guarantors of prosperity, whatever their individual merits upon other grounds, programs for public works, slum clearance, subsidizing of small business, foreign loans, social insurance, deficit government spending, redistribution of income, the numerous formulae for monetary management, repeal of the anti-trust laws, or any of the loosely-phrased admonitions that government should do nothing and allow everything to take its course untrammeled by controls of any kind.

On the positive side, the book urges clear recognition of the fact that prosperity, under a system of business enterprise, depends primarily upon the existence of competitive incentives that spur capital investment to provide better tools and equipment, that improve organization and technology to insure continuously increasing productivity per man-hour of work, and that enlarge markets by producing what the consumer wants at lower prices to the end that real incomes may be increased.

In short, prosperity depends upon profitable and expanding business and employment opportunity, so it becomes the part of enlightened government, business, agriculture and labor policy to promote those measures which will forward rather than retard the major aim of expanding production.

However great the room for dissent upon the adequacy, or the phrasing, of the specific recommendations it makes, the approach of this book has one virtue of solid merit. It attacks positively the problem of what steps should be taken to achieve and hold prosperity rather than merely devising a poultice to be applied when and if we run into a decline.

Virtually all responsible spokesmen for government, and for business, labor, and agricultural groups, are agreed upon the goal of prosperity. Moreover, they agree that, insofar as possible, it should be achieved through the effort of private enterprise, with government intervention utilized only as a last resort. But despite this unanimity, almost all public discussion of the problem has concentrated upon the nature, the extent, and the timing of such government expenditures as may be found necessary to combat deflation. Since upon this question there is far from general agreement, our procedure has created an exaggerated sense of divergence in a field in which, so far as fundamentals go, we all are in accord to quite an unusual degree.

☆ ☆ ☆

No confusion should be caused by the fact that the generally current phrase for prosperity is "full employment." The latter phrase merely states the goal in terms of human values, which are good terms in which to state any goal. What matters is that we generally are agreed as to what we mean when we say that we want prosperity or full employment. Not only do we know what we mean, but within very rough limits we can give dimension to our concepts. There are a few whose appraisals are somewhat lower, but most competent estimators set the goals for about 1950 at an average annual employment in civilian jobs of between 55 and 57 million persons, with a gross national product of between $185 and $200 billion measured at 1943 price levels. This contrasts with the 1944 level of non-military employed of 51½ million, and a gross output for the end of 1944 of over $200 billion. It assumes a reduction of the average workweek to 40 hours.

It will take some such levels as these to provide employment for those who seek work, with only sufficient "frictional" unemployment (those temporarily listed as unemployed because of the normal turnover between jobs) to afford reasonable labor-market flexibility to both workers and employers. The non-military employment figures are generally consistent with the officially stated postwar goal of jobs for 60 million workers, since the latter figure is generally understood to be an estimate of the *labor force,* which includes members of the armed services and an allowance for frictional unemployment.

There are a number of reasons why the estimates cannot be figured more closely, and why no one can be very confident even of the validity of the stated limits. The chief points of doubt in the employment estimates relate to how many withdrawals there are likely to be on the part of women, oldsters, and youngsters, who now are in the labor force to a number more than 6 millions beyond normal expectancy; how many men will be retained in the armed forces; and whether the

postwar frictional unemployment should be calculated as approximating the current 1 million or the 3 million so-listed in the prosperous year of 1929. Additional uncertainties cloud the estimates of gross national product. Notable among them is the fact that no one is sure of the war's effect upon man-hour productivity trends, in view of the fact that half of our current output has consisted of products that had no substantial counterpart in our peacetime price or production series.

☆ ☆ ☆

Nevertheless, despite such qualifications, it is fair to say that we do have a general conception of the magnitude of our postwar goals. Although they are well within our production potentials as demonstrated in this war, they are formidably beyond any previous record of peacetime achievement. Only the most sanguine optimism could lead one to expect that they will be achieved without concerted will, planning, and cooperative effort. Only blind recklessness could engender confidence that once attained they will automatically be held, let alone expanded in normally healthful growth.

If we were to follow past patterns, our war-built boom would, after a period of uncertain length, collapse into disastrous depression. The very magnitude of our recent growth would contribute to the depth and duration of the subsequent trough. Yet a fall even to the level of our previous peacetime-peak-year 1939, has been estimated by The Federal Reserve Board to imply unemployment for between 15 and 20 million persons. If human values have importance, that is something that must not be allowed to occur. If business values have importance, we must not tolerate again such losses as occurred from 1930 to 1933, when sales over the four year period were $128 billion less than would have been provided if the 1929 level had held, and corporate profits declined from more than $7 billions in 1929 to an average annual loss of $1 billion over the next four years. A repetition of these things cannot be tolerated—*if foresight and cooperative effort can prevent them.*

☆ ☆ ☆

In January of this year Senator Murray introduced in the Senate a bill entitled "The Full Employment Act of 1945." It instructs the President to submit to Congress plans for eliminating both unemployment and inflation, including recommendations for correcting structural defects in the economic system. It provides for a Joint Congressional Committee to consider the proposals of the President, to take testimony from experts and the general public on these proposals or any others it may wish to consider, and after weighing all the facts to submit its findings to Congress. It provides for an advance budgeting of the constituent parts of a full-employment economy, and commits the Federal Government to provide, in advance, for sufficient expenditures (through private contractor channels) to make up for the gap between estimated private expenditures and the amount necessary to assure full employment.

By no stretch of the imagination can The Full Employment Bill, in its present form, be regarded as acceptable to business. Yet it may well present a test of whether or not American business can deal with problems in this area in a statesmanlike fashion. Such statesmanship will consist in demonstrating first, that the Bill is not acceptable because of deficiencies which preclude the possibility of its accomplishing the avowed purposes; and second, that business is able and anxious to offer constructive suggestions for remedying these deficiencies.

It is easy to point to weaknesses in the Bill. To mention only a few of major importance: The proposal to make advance Federal expenditures to compensate for estimated deficiencies in prospective private expenditures is completely impracticable. No one in the country can predict future trends with sufficient accuracy for this purpose; no one can tell what the constituent parts of a really high, *stable* peacetime budget should be, for in our boom-or-bust economy we have no stable pattern to project; no one can tell, within reasonable limits, how much the government should spend *in advance* to assure full employment. The Bill pronounces labor's right to work without defining commensurate responsibilities which it should exercise. It does not define the areas of proposed government expenditure in such a way as to allay business fears of government competition or the general public suspicion of leaf raking. Above all, the Murray Bill is defective in that, despite a somewhat vague pronouncement in favor of forwarding private business activity, it recommends a single specific designed to supplement such activity rather than stimulate it.

The very definition of certain of these faults suggests their remedies. But the positive task of stating how the Bill should be amended in order that it may have effective usefulness is far from simple. Yet it is enormously to the advantage of American business to undertake it. Fortunately, there is a representative group sponsored by industry, The Committee for Economic Development, which has for some time been working intensively upon the problem, and which is excellently equipped to offer sound and progressive advice. It should be used for this purpose.

American business cannot afford to take a negative attitude toward legislation in this field. Some legislation undoubtedly will pass, for the problem is one in which there is a grave government responsibility. But equally there is a comparably important responsibility upon all citizen groups. None of them has more to gain or lose from the rise or fall of prosperity than American business.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Co., Inc.

THIS IS THE 34TH OF A SERIES

Electrical World

APRIL 28, 1945

Truman and Power

NOTHING COULD INDICATE more clearly the degree to which people believe that power has been a political football than the question one hears repeatedly—What effect will the change in presidency have on the trend of power development? There can be no question but what the policies of the late president had a most profound effect upon the course of power development; but because the record is so colorless there is some question as to whether President Truman has much interest in the subject.

It would seem, however, that there is a much more important question at this time—Has the attitude of the American public toward power changed materially in the past twelve years? Is it satisfied that the major abuses to which it objected have been taken care of substantially? This is important, because President Truman has had no mandate from the voters as claimed by his predecessor and therefore, in spite of his statement at his first press conference, might not be expected to champion causes until he had sensed a public urgency.

So long as the majority party had a leader who was an ardent advocate of government development of power projects it could be expected to strive for such a program in Congress. Without such intensive interest in the White House, Congress can hardly be expected to show similar solidarity on the power question without more convincing proof of a public demand. The public power group will be as solid as ever but the large number who have been passive on the question, voting as they thought the President expected them to vote, may decide things differently, especially if there is no White House pressure for something specific.

In other words, the change in administration can be counted as a favorable sign not that any legislation will be changed or regulation modified, but because it offers an opportunity for the power industry to get a hearing without having its case pre-judged adversely in advance. With people disposed to listen, no time should be lost in giving them the facts. It must be remembered that there are other interested people, such as government bureaus and agencies, that are counting on an expansion of public power for their own enlarged opportunities who heretofore have depended on the White House to promote the cause. Now they must fight their own battles and so far they have shown evidence of highly skilled and effective promotion.

While public power without its evangelist in the White House may be weakened, it would be foolish for anyone to think it can now be given a knockout blow. It has far too many friends for that. It is, however, facing the situation where it must subject its case to more unprejudiced analysis than formerly, with the result that its position in more than one way may have to be modified. If, for instance, it should lose its tax-free provisions on the grounds that it is a tax collector, there might be less reason for opposing the distribution of federally generated power by privately owned utilities.

All the while the battle has been raging Congress has listened to more unfavorable reports than good about the utility industry. Perhaps now the industry can find the time to sell itself to Congress and the public as a constructive force which has done great good in the past and is capable of contributing even more to the public economy.

Practical Aspects of Electric House Heating

Bonneville program would build 100,000 kw. of house heating load in 5 years—Utilities are open minded but view situation critically—They insist that rates be compensatory and not subject to later increase or withdrawal by changes in energy purchase terms

WALTER C. HESTON, Pacific Coast Editor, "Electrical World"

THE POSSIBILITY of large surpluses of hydroelectric power from Bonneville and Coulee Dam after the war has again stirred an interest in electric house heating, which nearly always occurs when there are large continuing surpluses of hydro-electric power. Witness the situation in Tacoma, Idaho Power and to a minor degree in many other areas in the Pacific Northwest. Bonneville Power Administration, being the one with the surplus power and looking for the market, is sponsoring and aggressively promoting electric househeating. The utilities, recognizing that the problem primarily is a function of what Bonneville charges for its power, are reported to be willing to promote this business if it can be done on a sound basis. Three fundamentals are at issue.

> **Electric house heating under the present rate set-up in the Northwest reminds one of the comedian, who said he bought pigs in the fall for $4 and fed them all winter and then sold them in the spring for $4. Whereupon the other comedian remarked "you can't make any money that way," and the first replied, "we found that out."**

Need Stable Basis

1. If private companies, municipals and public utility districts are to offer an electric house heating service to their customers they want it to be on a basis that will attract some business of this type. They are unwilling to offer a rate merely as a gesture.

2. They insist that the rate must be compensatory, that is, it must cover all the costs of rendering the service.

3. If they are to promote electric house heating they will do it only on a basis that will insure permanency of the rate. They do not want to get into a situation in which it may be necessary to increase or withdraw the rate after some volume of business has been built up. This has happened in two notable cases in the Northwest in the past.

In a recent article in "Fortune" the Bonneville Power Administration indicated that it expects electric house heating in the Northwest to develop a load of 100,000 kw. during the first five years following the war. Such an ambitious program calls for a thorough economic and engineering analysis of the whole question of electric house heating. Few realize the magnitude that house heating load will reach with only a modest saturation. When an electrically heated house has a diversified demand of from 6 to 12 kw. depending upon climatic conditions it does not take many houses multiplied by such figures to equal a staggering number of kilowatts. In fact, with 25 percent saturation on the average Northwest utility system, the house heating load would assume proportions greater than present system demand for *all* services now rendered. Realizing this and other aspects of the problem, utility engineers are viewing critically the whole program.

Many enthusiasts of electric house heating have been thinking only in terms of types of utilization equipment that will do the heating job in the house and that will make the load the least objectionable, or least inexpensive, for the utility to serve. Utilization equipment, which of course will largely determine load characteristics, is of the greatest importance, but before engineers worry too much about that phase of the problem, they want to make sure they can deliver energy at a price the user can afford to pay and assure themselves at the same time that they will not lose money.

Factors of Competition

All electric rates are competitive to a greater or lesser degree with some other means of supplying the particular need. Certainly in the case of electric house heating the competition with gas, oil, coal and wood is very definite and very close to the customer's pocketbook. How much of a premium the customer is willing to pay for the more desirable electric heat, is one of the first questions.

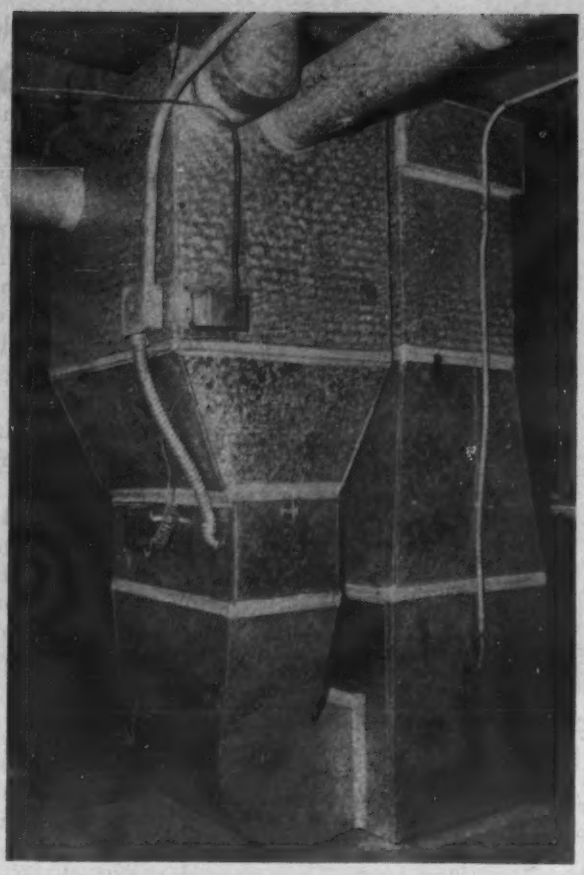
Modern automatic oil and coal house-heating plants will produce the heat equivalent of a kilowatt-hour (3,412 B.t.u.) for 3 to 4 mills. The rate to the consumer most talked of for electric house heating is 7 mills per kw.hr. That some load can be developed at this figure is evident from the fact that since 1940 there have been 30 houses and 100 apartment-

courts in Portland and 50 to 60 houses in Longview heated electrically on a 7-mill rate. Users are said to be satisfied.

If Bonneville's goal is to be reached, it is very doubtful, however, whether it can be done with this much spread between the cost of electrical energy and competitive fuels. More likely, a rate of 5 mills would be necessary to develop any great volume of house heating.

If cost of distribution for house heating on the average Northwest utility system is about 3 mills, which may be somewhere nearly correct, then cost of generation becomes an important factor in determining the rate to the consumer. If this reasoning be sound and these figures approximately correct, then it means that agencies distributing Bonneville power for house heating cannot afford to pay more than about 2 mills for energy. This is the same as Bonneville's $17.50 per kilowatt-year rate at 100 percent load factor. It is said that purchasers of Bonneville firm power in large blocks and at good load factor are paying from 3 to 5 mills for their firm requirements under the present method of applying the schedule. To take on house heating under this same rate and using the same "formula" they would pay about one percent for incremental kilowatt-hours sold for house heating. Manager Harry Kelsey, of the Cowlitz County PUD, that serves Longview, Wash., where there are 50 to 60 electrically heated houses, is credited with a public statement in which he said in effect that he is losing about $30 a year in each house heating account under the present Bonneville wholesale rate.

Quite obviously, something will have to be done about this rate situation if any house heating program in the Northwest is to receive support of the various agencies serving the residential customers of that area. Bonneville is cognizant of this situation, but seems disposed to expect the utilities to take a certain amount of gamble in the exploitation of electric house heating and not worry too much about the wholesale rate they pay for Bonneville power. It is not intended hereby to place the whole burden of solution in the lap of Bonneville. Perhaps the utilities *will* gamble to some extent if they consider the stake worth it. Utilities may be able to do more to reduce their distribution costs, as has been done by the Washington Water Power Co. with its 13-kv. primary distribution system. If they are to go into house heating, new techniques will be called for. Perhaps an inexpensive light weight, compact dry-type transformer that would operate from a 2,300-volt sub-distribution network would be a step toward reducing distribution costs.



ONE METHOD OF UTILIZING electrical energy for house heating is by means of a central warm air electric furnace. This shows a recent installation in Portland, Ore., in which eight 2-kw. strip heaters are placed in the filtered, forced-air circulating system. Chromolox strip heaters are controlled in 2-kw. steps by a Minneapolis-Honeywell control. Furnace was manufactured by Ace Electric Co. of Portland

Some sales people who are inclined to go along on anything and everything that looks like postwar domestic load, argue that it will all "come out in the wash." They point to the engineer's skepticism when range and water heating loads were in the pioneering stages and say, "Now look, everything turned out all right and the engineer's slide rule was wrong." They overlook, however, a basic difference in character of the loads. Ranges and water heaters had inherently good diversity possibilities by the very nature of the devices and the services they perform. Too, they offered possibilities of increasing system load factor, which was not seriously doubted from the beginning.

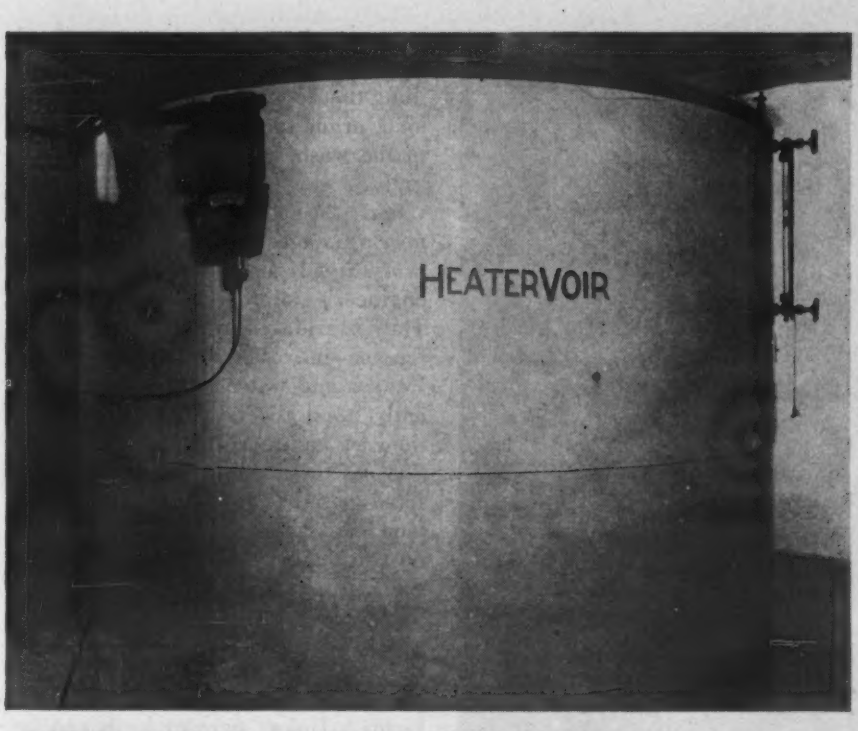
Load Characteristics

What of electric house heating? Certainly diversity does not look too promising on cold days. What of load factor? Unless summer loads can be developed, annual load factor would be poor. Irrigation is spoken of as the compensating summer load. Large summer pumping loads upwards of 500,000 kw. will develop, no doubt, but since such load would fall on transmission lines and rural lines, it would have no value at all as regards load factor of city distribution systems where a very large investment would be tied up for a distinctly winter load.

What of the heat pump, or reverse cycle refrigeration? If someone can develop a practicable unit that will operate in the Northwest climate and which can be sold as a package job at reasonable price, then it would have great possibilities. Herein might lie the solution to the rate problem and high demand per house. The heat pump would offer as well a partial solution to the annual load factor problem as sections of the Northwest, east of the Cascades can use some summer cooling.

What of heat storage, off-peak house heating plants? Those who see these systems as the *only* answer, should not overlook the fact that with any appreciable saturation of house heating, the heating load becomes the determining factor in the daily load curve, and troubles are only shifted to some other time of day. This would occur on some systems with a saturation as low as two percent.

Panel heating is another general approach to the application problem.



ANOTHER APPROACH TO ELECTRIC HOUSE HEATING is with heat storage systems. Here is shown a trial installation in Spokane in which immersion heaters are applied to a well insulated water tank. Air passing through the finned center of the tank is distributed by a warm-air piping system. Only 6-hr. input out of 24 is required to maintain a constant 70 deg. in the house

This would seem to offer good possibilities, but much remains to be done in the way of development. Perhaps some manufacturer will develop a heating pad similar to an electric blanket which could be placed under rugs to supply the radiant heat. How about panel heating built into the floor? Panel heating, like the heat pump, offers possibilities of providing comfort with less kilowatt-hours than other systems.

The fourth general method of applying electric heat is with space heaters or resistance type central furnaces. One of the latter is shown in an accompanying photograph. Of the four methods of attacking the house heating problem, only space heating, or its variation, the central hot air furnace, has reached a stage of development where it can be offered immediately post-war as a package job at reasonable price.

It is therefore likely that if and when an electric house heating program gets under way in the Northwest, the means of application will be space heaters. These of course, will have to be thermostatically controlled and perhaps a heater in one room will be double-throw switched against another to help keep down demand. It is almost certain that rates will have a demand feature to induce the customer to divide his heating load up into small units and to encourage 24-hr. use. Service may or may not be separately metered.

What the answer is to all these questions, no one at present is prepared to say. Certainly on the very face of the proposition there is a huge amount of energy involved in electric house heating, at doubtful load factor and at a very low rate. If purchasers of Bonneville power in large blocks at high load factors cannot earn a better rate than 3 to 5 mills under present methods of applying the schedule, how is it in the cards to sell power at retail for house heating at 5 mills at an annual load factor of around 25 percent? What is there about house heating that justifies a rate of 7 mills, or 5 mills when few large industries operating at high load factor can earn rates as low as 5 mills?

If there were a lot of dump power or stream-flow power available in the Northwest during the winter heating season, that might considerably alter the situation. Unfortunately, at least for house heating, this load would come at a time of year when stream flow is low and it would be necessary to draw the kilowatt-hours from storage and at the very time that storage should be held against other seasons of the year.

It is not the purpose of this discussion to throw cold water on the electric house heating idea, but rather to stimulate more realistic thinking on the whole subject with the hope that conclusions reached will be based upon sound reasoning.

Heaven knows that the electrical industry and everyone connected with it wants to build load, but when a mass heating job like electric house heating with a premium fuel is considered, the industry certainly should weigh carefully the whole proposition before the public appetite is whetted too keenly for a service that may be limited to only those in the upper income brackets. Might it not be better that the energy be used to do those things that only electricity will do so preeminently well?

Additional information on the "Heatervoir" shown on this page is taken from the "Illuminator," employee publication of the Washington Water Power Co.:

The heater is built in the shape of a doughnut. It has a capacity of 700 gal. of water but only about 500 gal. were used in the experimental installation in Spokane. There are positions for eight immersion heaters of which four units of 5-kw. capacity each have been installed. In addition, there is a 5-kw. air heater within the center opening. Total installed heating capacity is thus 25 kw. The water does not circulate outside of the boiler.

Air is drawn through a humidifying filter, then passes around germicidal lamps. A fan then forces it up through the center space of the boiler where it picks up heat from fins welded to the boiler. A damper at the top of this passage is controlled by a thermostat in the living room. When the living room calls for heat a motor opens this damper, at the same time starting the fan, the 5-kw. air heater, the germicidal lamps and the humidity spray. When the room thermostat is satisfied it shuts the damper, cuts out the fan, heater, spray, and lamps.

Data on operation of the installation during the past winter were taken from watt-hour and recording demand meters and from a thermometer in the boiler and a thermostat in the living room, both recording instruments.

Electric Power from the Wind—I

Feasibility for use of wind power as adjunct to existing power sources found in Federal Power Commission study—Details of design and advantageous operation of 7,500-kw. twin-wheel unit on 500-ft. tower

ANALYSIS OF THE RECORDS of the U.S. Weather Bureau indicates that there is far more justification for application of wind-power for electric generation than has been realized. Such a study by Percy H. Thomas, office of chief engineer, Federal Power Commission, has been so reassuring as to warrant the detailed design of a 7,500-kw. wind-power generating station—so far as is known, by far the largest anywhere. It involves two 2-blade turbine wheels at the ends of a 200-ft. bridge rotatable at the top of a 500-ft. tower. Each wheel is geared through speed-raising bevel gears to the electric generating system housed in a circular generating room at the center of the bridge. (Fig. 1). Ensuing information is from Mr. Thomas' survey report "Electric Power from the Wind" just released by F.P.C.

These values contrast with the 110-ft. tower height of the single-wheel 1,000-kw. experimental unit on Grandpa's Knob near Rutland, Vermont. That installation further differs from the Thomas design in that it has coning and feathering of the blades to render the speed of the unit independent of the wind velocity. This was done to maintain 60-cycle output for synchronization with the system of Central Vermont Public Service Corporation.

In contrast, the wheel speed of the Thomas design is proportional to the wind velocity up to 34 m.p.h. for which the rotational speed is 42.75 r.p.m. At that speed the calculated delivered capacity is 7,700-kw.

To reconcile the desired fixed ratio between the speed of the wheel and the varying velocity of the wind, with the constant frequency requirement of the utility system, the wind turbines drive a direct current generator instead of an alternator. The generator is designed to function from full speed down to 40 percent of full speed. Its output is fed to a rotary converter which runs (inverted) in synchronism with the alternating current system to which the output is delivered. As an alternative rectifiers may be used, likewise inverted, for the conversion function. With the speed of the rotary converter and the rotational velocity of the wheels thus rendered independent of one another, it remains only to control the load imposed on the wind turbine and, in turn, its speed.

Voltage of the d.c. generator is determined by the wheel speed and the amount of field excitation. Load on the wheel is then controlled by automatic manipulation of the generator field and the transformer ratio to bring the wheel speed and the flow of energy to that appropriate to any value of wind velocity within the operating range. As wind velocity rises above 34 m.p.h. the wheel velocity is kept constant or decreased somewhat if necessary to avoid overloading. When a dangerously high wind velocity or icing occurs, the system is shut down. Schematically the electrical system is as shown in Fig. 2. and the proposed layout of the generating room as in Fig. 3.

The 7,500-kw. generator has been designed to be used on a location where the average wind available is in the range from 23 to 25 m.p.h., the same range for which the Putnam-S. Morgan Smith installation at Grandpa's Knob is designed.

However, the study of wind velocities and durations has revealed numerous regions where the average wind is well below the above value. For these areas a second design has

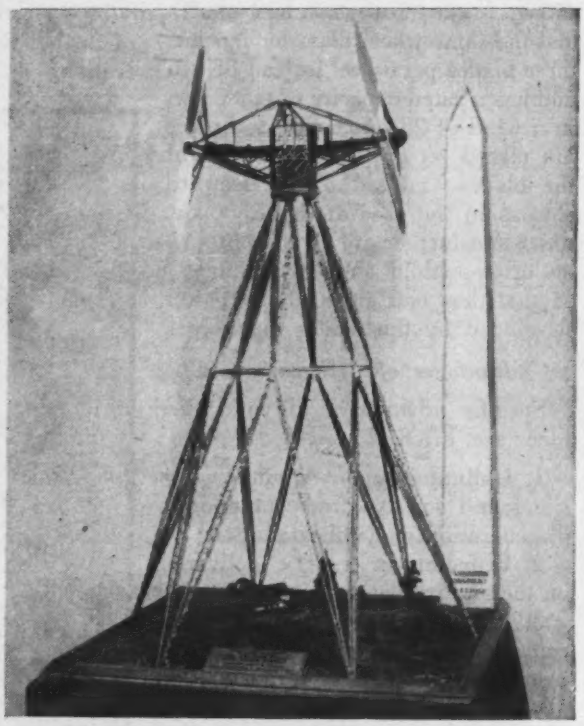


FIG. 1—Model of Percy H. Thomas' design of twin-wheel unit to develop 7,500 kw. in 34 mile-per-hour wind. Tower 475 feet high to wheel shaft. Wheels geared to d.c. generator in central generator room. Variable-speed output rectified by synchronous inverter. No coning or feathering of blades as in Grandpa's Knob design. Each blade is 80 ft. long and weighs 30 tons.

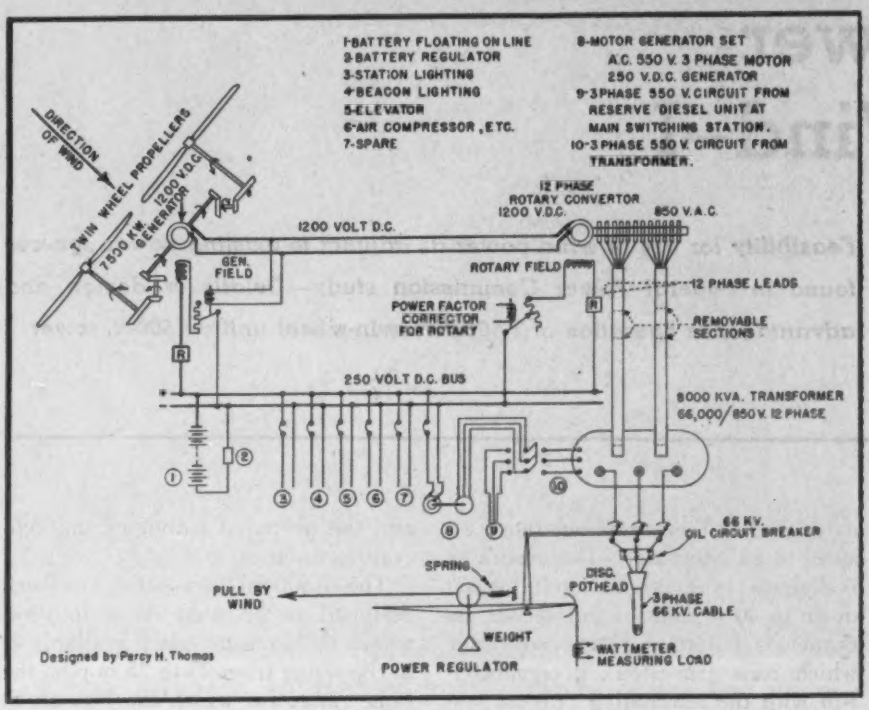


FIG. 2—Schematic arrangement of wind-turbines, gears, d.c. generator, synchronous inverter, step-up transformer and auxiliaries for 7,500 kw. unit

been made, adapted to a wind-velocity range from 18 to 21 m.p.h. (See cover)

This second design utilizes the same 475-ft. tower (base to wheel shaft) and the same wheel diameter but has three blades per wheel instead of two and has a rated capacity of 6,500 kw. in a wind of 28 m.p.h. Blade braces are placed on the windward side of the blades (instead of the leeward side as in the case of the 7,500-kw. unit) and further are given appropriate cross-sections and "blade angles" so that they can augment the power developed by the blades themselves.

Advantages of Aerogeneration

Specific advantages of wind turbines are, briefly:

1. Unlimited supply of wind at any site found suitable from standpoints of generation and utilization.
2. Prime-mover energy delivered on the site by nature—free.
3. No substantial variation in cost can occur after the investment and installation are made.
4. Simple structure and simple operation.
5. Transmission costs lowered by use of sites widely distributed but near load centers, particularly those remote from fuel and hydro plants.
6. Potent stabilizing effect of numerous distributed units each with important flywheel merit and voltage stabilizing synchronous characteristics.
7. Construction costs low.
8. Operating costs low and capable of further lowering by automatic operation.
9. The higher the average sustained value of wind velocity, the lower the cost per unit of generating capacity.

Assignment of Wind Energy

Absorption of wind-generated energy into a utility power-system can be well illustrated by taking a typical but hypothetical load curve along with steam and hydro capacity. In Fig. 4 there is a 10 percent peak increment representative of late afternoon load in fall or winter in which a large domestic load overlaps the industrial load. It is assumed that there is seasonal storage in hydro reservoirs about sufficient to carry this peak and that there is stream flow with weekly pondage at other points sufficient to carry the morning and afternoon "plateaus" of load (marked 2 on Fig. 4). Any run of river capacity would appear along the base of the load diagram.

Assumed variations of the energy delivered from the wind generators are indicated as the wavy curve over areas 7 and 8 at the bottom. The average energy capacity (available in the critical or near-peak hours) is indicated by the dot and dash line and the diversified minimum energy capacity by the solid line.

For comparison the wind-energy curve over and above the diversity

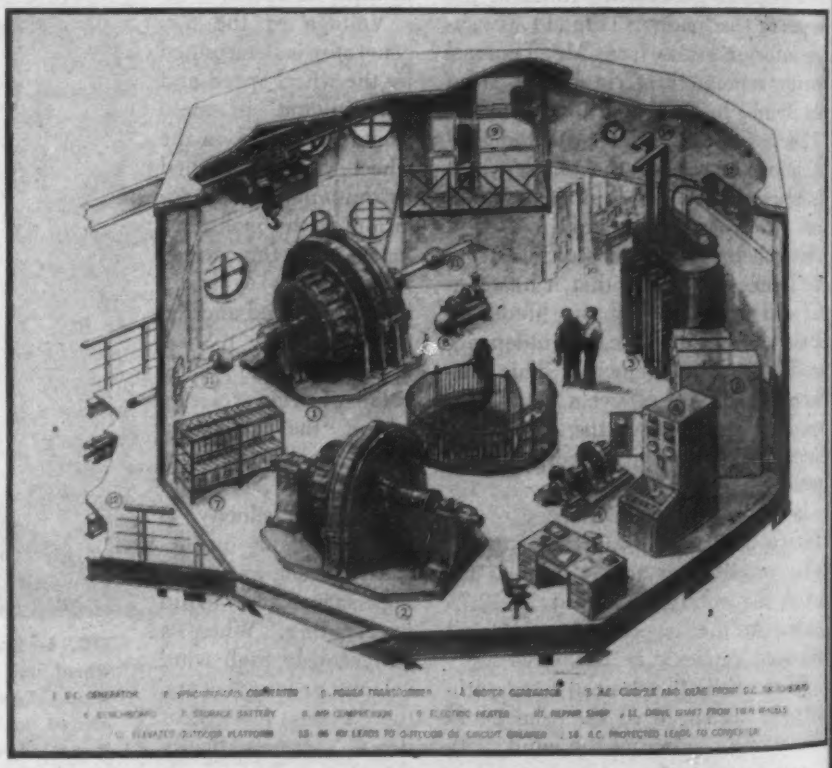


FIG. 3—Proposed arrangements of central generating room, rotating with the bridge as the two wheels are kept faced into the wind

Wind Power, with Steam and Hydro Power, in Utility System: Peak Demand, 2,000,000 Kilowatts

Preliminary Cost Data

System capacity utilized at time of peak demand:		
Steam, hydro, and wind power	2,000,000 kw.	
Wind power installation, rated capacity	600,000 kw.	
Annual capacity factor, wind turbines	50%	
Wind power energy:		
Equivalent continuous kilowatts, energy rating	300,000 kw.	
Minimum capacity from diversified wind energy	200,000 kw.	
Capacity from "firming" hydro units	100,000 kw.	
Installation cost, wind turbines, at $68 per kilowatt	$40,800,000[2]	
Installation cost, "firming" hydro[1]		
Energy from wind turbines, annually	2,628,000,000 kw.-hr.	
Fixed charges, in percent	6.0	10.5
Fixed charges, wind power only, mills per kilowatt-hour	.93	1.63
Operating cost, at $1.80 per kilowatt of wind turbine installation, approx.	$1,080,000	$1,080,000
Operating cost, mills per kilowatt-hour	0.41	0.41
Total cost of energy, wind power only, mills	1.34[2]	2.04[2]

[1] Cost of installing additional hydro capacity in existing plants, for "firming" wind power, will vary widely with conditions found at such plants. The incremental cost of "firming" hydro capacity installed in new plants at time of construction will probably range from $40 to $60 per kilowatt.

[2] These indicated energy costs are predicated upon the assumption that all wind energy potentially available would be generated; that is, that the market would absorb the entire output.

NOTE: Of the 300,000-kw. energy rating prescribed for the wind, 200,000-kw. is firm power due to diversity.

capacity has been reproduced near the top of the load curve. Gaps (marked 3) in this wind-energy contribution (marked 4) are filled in by the "firming" hydro capacity provided to stabilize the wind power. The portion of the wind-energy not used at the peak (areas marked 7) is steam replacement energy. The portions marked 8 are used as pondage or storage replacement.

Capital Costs

In the absence of actual construction experience only an estimate can be offered as to the cost per kw. of the 7,500-kw. unit described. This approximation was based on an assumed contract for 10 units erected in groups on two or three neighboring sites, simultaneously or consecutively. The cost includes the complete structure designed with ample factors of safety to meet the stresses encountered.

The resulting estimated cost is $68 per kw. including all recognized indirect and overhead expenses including insurance. This is the cost per kilowatt of rated capacity (each 7,500 kw.). The cost per kilowatt of energy rating (average energy deliverable from the wind by a particular generator at a particular site with a particular wind-duration curve) depends on the capacity factor. The capacity factor may range from 40 to 60 percent.

Overall Cost of Energy

It is assumed that the operating costs will fall between ⅓ and ½ mill per kw.-hr. This is predicated on five adjacent units requiring eleven shift operators, a foreman, repairman and assistant. Maintenance, supplies and repairs have been provided in a sum equal to that for operating labor. Annual operating cost totals, thus, to $1.80 per kw. of rated capacity. Output is taken as 98 percent (2 percent for ordinary outages for repair or inspection) of that obtainable on 50 percent load factor operation.

In order to combine these capital and operating costs to obtain an overall cost per kw.-hr. of wind-generated energy it is desirable to consider utilization of the wind power in a series of interconnected networks having a high aggregate capacity. This affords an opportunity for wide dispersion of the wind turbine installations and correspondingly favorable diversity.

As shown in the table the wind-generated energy will cost 1.34 or 2.04 mills per kw.-hr. depending on whether fixed charges are taken at 6 or 10.5 percent. This is with the wind-turbines operating at 50 percent annual capacity factor and contributing a minimum of 200,000 kw. or 10 percent of the 2,000,000 kw. of peak demand. Prescribed capacity is 300,000 kw. with a firming capacity of 100,000 kw. equalized by hydro storage.

Further Development

In the Federal Power Commission survey report from which these statements have been adapted, by permission of Chairman Basil Manly, the author, Percy H. Thomas, recommends that a full-size experimental unit be built and equipped with instruments to permit continuing analysis of the performance and that the study of the wind and wind records be intensified.

Conducive to consideration of wind power is the circumstance that areas of the United States remote from hydro and from fuel resources are the areas which present relatively constant winds of high average velocities. This supporting information will be brought out in an ensuing installment.

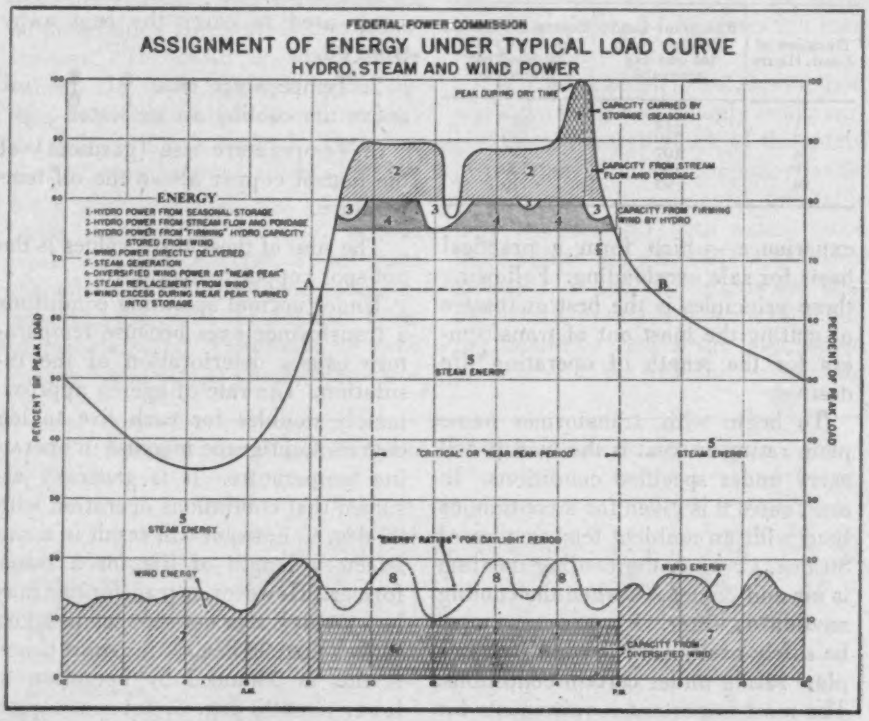

FEDERAL POWER COMMISSION
ASSIGNMENT OF ENERGY UNDER TYPICAL LOAD CURVE
HYDRO, STEAM AND WIND POWER
PEAK DURING DRY TIME
CAPACITY CARRIED BY STORAGE (SEASONAL)
CAPACITY FROM STREAM FLOW AND PONDAGE
CAPACITY FROM FIRMING WIND BY HYDRO
ENERGY
1-HYDRO POWER FROM SEASONAL STORAGE
2-HYDRO POWER FROM STREAM FLOW AND PONDAGE
3-HYDRO POWER FROM "FIRMING" HYDRO CAPACITY STORED FROM WIND
4-WIND POWER DIRECTLY DELIVERED
5-STEAM GENERATION
6-DIVERSIFIED WIND POWER AT "NEAR PEAK"
7-STEAM REPLACEMENT FROM WIND
8-WIND EXCESS DURING NEAR PEAK TURNED INTO STORAGE
PERCENT OF PEAK LOAD
STEAM ENERGY
"CRITICAL" OR "NEAR PEAK PERIOD"
"ENERGY RATING" FOR DAYLIGHT PERIOD
WIND ENERGY
CAPACITY FROM DIVERSIFIED WIND
A.M.
P.M.

FIG. 4—Approximately five percent of the daylight output of a representative system shown carried by wind-power if firmed by hydro storage. Wind excess (areas 8) during near-peak period turned into hydro storage. Diversity contributes an additional ten percent

What Is Safe Practice in Overloading Transformers

A presentation of rules and guides for the safe overloading of power and distribution transformers together with a series of charts and tables for estimating the thermal performance of transformers under "recurring daily" and "annual emergency" overloads*

W. C. SEALEY, Engineer-in-charge, Transformer Division, Allis-Chalmers Mfg. Co., Milwaukee, Wis.

OVERLOADING TRANSFORMERS has become more or less of an accepted practice, particularly under the demands of wartime operating conditions. But, because it actually is a flaunting of the "rules of operation," it can be an unsafe and costly practice. Fortunately, overloading has its rules—a combination of theory and experience—which form a practical basis for safe overloading. Following these principles is the best guarantee of getting the most out of transformers for the length of operating life desired.

Table 1—Safe Hottest Spot Temperature, Degrees C.

Duration of Load, Hours	Recurrent Loads (365 per year) (at one day intervals)	Emergency Loads (one per year) (at one year intervals)
1	112	137
2	110	130
4	107	125
8	105	120
24	95	110

To begin with, transformer name plate rating in kva. is the load it will carry under specified conditions. In most cases it is given for a continuous load with an ambient temperature of 30 deg. C. when the cooling medium is air and 25 deg. C. when the cooling medium is water. A transformer may be safely overloaded beyond its name plate rating under certain conditions. The most important requirements for safe overloading is that the hot-spot copper temperature of the winding shall not exceed a safe value. Consequently, a method of determining and limiting the hot-spot temperature is the first step in overloading transformers.

Analysis of Hot-Spot Temperature

For convenience in analysis, the hot-spot temperature of a transformer can be divided into three parts:

1. Temperature of cooling air or water used to carry the heat away from oil.

2. Temperature rise of the oil above the cooling air or water.

3. Temperature rise (gradient) of the hottest copper above the oil temperature.

The sum of these three values is the hot-spot copper temperature.

Under normal operating conditions a transformer ages because temperature causes deterioration of the insulation. The rate of ageing approximately doubles for each five to ten degrees Centigrade increase in operating temperature. It is generally assumed that continuous operation with 95 deg. C. hot-spot will result in a satisfactory length of life for a transformer. However, a transformer may be operated at a hot-spot temperature higher than 95 deg. C. for short times, if this is balanced by operation at lower than 95 deg. C. hot-spot copper temperature for a sufficient time. If a shorter life than normal is satisfactory to the user, the duration of each operation at high temperatures can be for a longer period.

One method of insuring long period of operation at lower temperatures, to permit overloading without premature ageing, is to limit the frequency of such overloads. Two sets of temperature-time values may be set up, one for recurrent loads and the other for emergency loads as in Table I. Values for *recurrent* loads are based on only one load-time condition occurring during which a 95 deg. C. hot-spot is exceeded in any 24-hour period. If this condition obtains and temperature does not exceed the table value, the increased rate of ageing can be compensated for by holding hot-spot temperature below 95 deg. C. for the remainder of the time. However, if these lower temperatures do not occur there will be a reduction in the total life of the transformer. The safe hot-spot temperatures listed in Table I for emergency loads are for loads which occur not more often than once a year. They represent much greater ageing.

Table 2—Typical Transformer Constants

Item	Self-cooled or water-cooled transformers	Forced-air or forced-oil cooled transformers
Hot Spot Copper Rise Degrees C.	65	65
Hot Oil Rise	45	35
Ratio of Copper Loss to Core Loss at F.L.	2	4
Thermal Time Constant (time required to reach ultimate temperature if all heat were absorbed)	3	2

* Although presented differently, many of the values given herein are the same as those in the various guides for operation of transformers published by the AIEE and ASA, but departures have been made from such values to eliminate inconsistencies or to simplify the rules and their application.

Table 3—Safe Loads (XFL) for Various Oil Temperatures

Type of Transformer	Oil Temp.	Recurrent Loads			Emergency Loads		
		2 hours	8 hours	24 hours	2 hours	8 hours	24 hours
Self-cooled	40	1.9	1.8	1.65			1.9
	45	1.8	1.75	1.55		2.0	1.8
	50	1.75	1.65	1.45		1.9	1.75
	55	1.65	1.55	1.35	2.0	1.8	1.65
	60	1.55	1.45	1.25	1.9	1.75	1.55
	65	1.45	1.35	1.1	1.8	1.65	1.45
	70	1.35	1.25	1.0	1.75	1.55	1.35
	75	1.25	1.1		1.65	1.45	1.25
	80	1.1	1.0		1.55	1.35	1.1
	85	1.0			1.45	1.25	1.0
	90				1.35	1.1	
Water-cooled, forced-air, forced-oil-cooled	40	1.7	1.6	1.45	2.0	1.85	1.7
	45	1.6	1.55	1.4	1.9	1.75	1.6
	50	1.55	1.45	1.3	1.85	1.7	1.55
	55	1.45	1.4	1.2	1.75	1.6	1.45
	60	1.4	1.3	1.1	1.7	1.55	1.4
	65	1.3	1.2	1.0	1.6	1.45	1.3
	70	1.2	1.1		1.55	1.4	1.2
	75	1.1	1.0		1.45	1.3	1.1
	80	1.0			1.4	1.2	1.0
	85				1.3	1.1	
	90				1.2	1.0	
Hot spot temperature C. Degrees C		110	105	95	130	120	110

If full life of the transformer is to be secured, each cycle of operation at a recurrent load above 95 deg. C. should be compensated for by 16 hours of operation below 80 deg. C.

Similarly each cycle of operation at an emergency load above 95 deg. C. should be compensated for by 2,400 hours of operation below 80 deg. C. Hours of operation below 80 deg. C. need not be consecutive or in the same year. In most applications this operation below 80 deg. C. will normally occur.

When a transformer load is being considered, therefore, it should first be determined whether this is a recurrent load or an emergency load. If the load recurs on a daily basis the specified temperature or load for recurrent loads should not be exceeded. For other times of load recurrence interpolation is permissible using the interval of overload occurrence as the base.

Known Factors

To determine specific values of loads for various times the transformer characteristics must be known. For calculating permissible overloads on transformers, typical values of transformer constants are given in Table 2. These values are used with slight variations as the base for calculating safe overloads of transformers. Overloads so obtained will be safe for the windings of most oil-immersed distribution or power transformers. They will be too high for a few transformers.

Thermal circuits of transformers are complex. Heating of the transformers and cooling conditions change continually, therefore, too much precision should not be expected in determining safe loading of transformers. Safe temperatures have a theoretical basis in the ageing of insulation samples, coupled with operating experience in overloading transformers. Thus rules for overloading transformers are a practical rather than a precise basis for safe overloading.

Methods of Overloading

If the general principles to be outlined are followed, specific values can be determined for overloading transformers. The form in which these values are given depends upon the data available and the use for which the information is desired. Thus one method may be used when planning for a given overload and another to check whether the overload is safe while it is being carried. In all cases the values of safe loads and safe temperatures are given for different types of transformers. Tabulation in each case is based on the characteristics of typical transformers and will be safe for most oil-immersed power and distribution transformers.

These methods are similar in principle and results. However, they differ in details of application, so each will be considered as a separate method.

Overloading Method No. 1

By Oil Temperature and Load Current—Hot-spot temperature rise of a transformer in operation is estimated by taking the sum of the oil temperature, and the temperature rise (gradient) of the hottest copper above the oil temperature, for the load being carried. Gradient values given in Table 7 are safe for the most transformers. Add to this the oil temperature. The estimated hot-spot temperatures so obtained should now be checked against the safe hot-spot temperatures of Table 1 corresponding to the frequency of recurrence and the duration of the load.

Alternate means of applying the principle of loading by oil temperature and winding gradient (corresponding to the load carried) are possible by using Table 3. Safe loads corresponding to various oil temperatures and load durations, are shown in Table 3. If the oil temperature for a self-cooled transformer carrying a recurrent load is 65 deg., the load should not exceed 1.35 times full load for 8 hours.

It is good practice to use this method while the loads are actually being carried, as an overall check of the safety of the load. Actually for many transformers the values given in this table may be exceeded with safety since these values are generally applicable. However, if the indications are that the load is unsafe, supplemental cooling should be used or the load should be reduced if the transformer winding

Table 4—Safe Loads (XFL) for Various Load Durations

	Duration of load, hr.	Recurrent Loads (XFL)			Emergency Loads (XFL)		
		Following full load	Following no load	Hot spot temp., °C.	Following full load	Following no load	Hot spot temp. °C.
Self-cooled and water-cooled	1	1.35	1.6	112	1.75	2.0	137
	2	1.25	1.4	110	1.55	1.7	130
	4	1.15	1.25	107	1.4	1.45	125
	8	1.1	1.1	105	1.3	1.3	120
	24	1.0	1.0	95	1.2	1.2	110
Forced air-cooled and forced-oil-cooled	1	1.2	1.4	112	1.55	1.75	137
	2	1.15	1.3	110	1.40	1.5	130
	4	1.1	1.15	107	1.3	1.35	125
	8	1.1	1.1	105	1.25	1.25	120
	24	1.0	1.0	95	1.15	1.15	110

This Table is based on 25 deg. C. ambient for water cooled transformers and on 30 deg. C. ambient for other transformers.

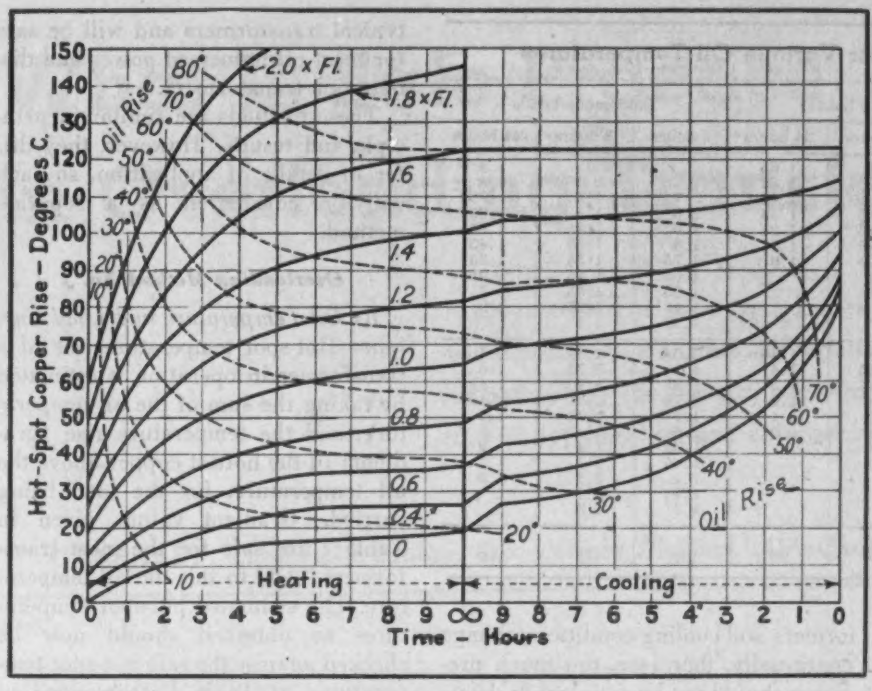


FIG. 1—Heating and cooling curves for typical self-cooled or water-cooled transformers

is not to be injured.

While this method is chiefly used for checking safety of a load being carried it provides a ready means for taking into account the effect of decreased ambient temperature and supplemental cooling. It is not directly applicable when planning for overloads in advance.

Overloading Method No. 2

By Safe Load and Time Values Following Continuous Load—Values of safe overloads that can be applied for various periods following full load are given in Table 4. These values are based upon a 25-deg. ambient temperature for water-cooled transformers or a 30-deg. ambient for other transformers. This table also indicates the corresponding values of hot-spot temperature for the loads given. Loads given may be increased up to twice the full load when the average daily ambient temperature is less than 25 deg. C. for water-cooled transformers, or 30 deg. C. for other transformers. Table 5 gives the fraction of full load by which the loads in Table 4 can be increased for lower ambient temperatures.

This approach is useful in planning for circumstances where a constant load for a long period is followed by a greater load for a shorter number of hours. Although values are given only following "no-load" and following "full-load", values following intermediate loads may be obtained by interpolation. The 24-hour loads of Table 4 may be increased up to a maximum total load of two times full load in accordance with Table 6 where load factors are less than unity.

Table 5—Safe Increase in Load for Equivalent Ambient Temperatures Below 30 Deg. C.

Equivalent Ambient Temperature Degrees C.	Safe Load Increase Expressed as a Fraction of Full Load		
	Self cooled	Forced air and forced oil cooled	Water cooled
30	0	0	
25	0.05	0.04	0
20	0.10	0.08	0.05
15	0.15	0.11	0.10
10	0.20	0.15	0.15
5	0.25	0.19	0.20
0	0.30	0.22	0.25

Overloading Method No. 3

Using Load Factor and Equivalent Ambient—It is impossible to predict what the ambient temperature will be on the day when overload will occur. However, by using the principle of equivalent ambient temperature, advantage may be taken of the fact that one warm day may be compensated for by following cooler days.

A transformer may be overloaded by the fraction of full load shown in Table 5 if equivalent ambient temperatures equal those listed. Equivalent yearly ambient temperatures for various localities for use with Table 5 are listed as Table 8. Either the daily, monthly or yearly equivalent ambient temperatures may be used in applying this correction. But if the yearly temperature is used the monthly or daily temperature should not be used, unless one is willing to accept the accompanying sacrifice of life.

In addition to the correction for ambient, if the daily load factor is below 1.0 the loading may be increased in accordance with Table 6 with the additional restriction that the maximum load on the transformer

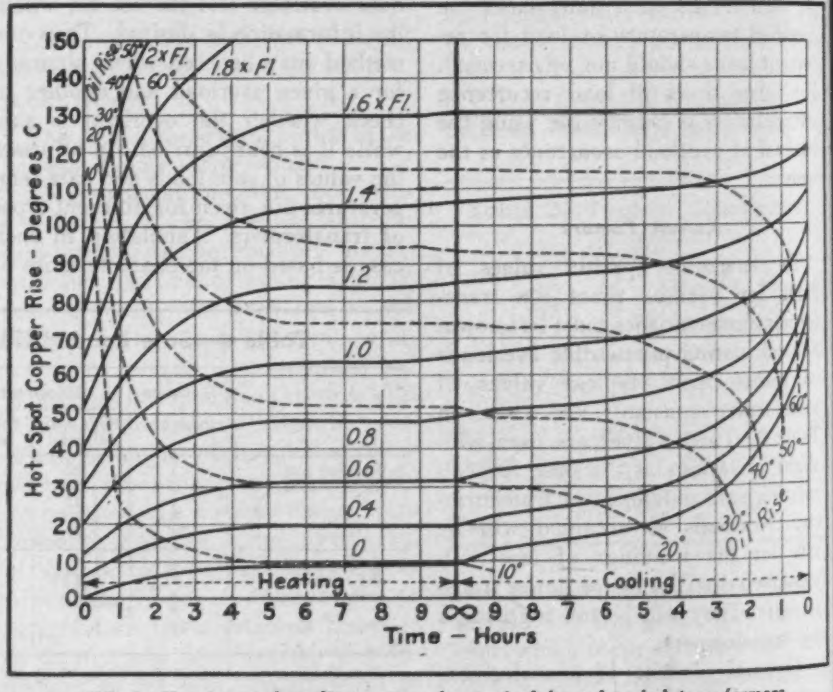


FIG. 2—Heating and cooling curves for typical forced-cooled transformers

Table 6—Safe Increase in Load for Daily Load Factors Below 1.0

Daily Load Factor	Safe Load Increase Expressed as a Fraction of Full Load	
	Self cooled	Water cooled and forced cooled
1.0	0	0
0.9	0.03	0.02
0.8	0.06	0.04
0.7	0.09	0.07
0.6	0.12	0.09
0.5	0.15	0.11

should not exceed twice full load.

This approach to overloading is applicable when the only information available is the load factor and the estimated ambient temperature. For widely varying loads it may give lower values of permissible overloads than the other methods.

Overloading Method No. 4

Using Fundamental Curves—If the loading condition to be planned for does not readily fit into one of the previous methods the safety of the desired load may be predetermined by: (1) calculating the temperature rise which will exist by using the curves of Figures 1 or 2; (2) adding the estimated ambient temperature to obtain the hot-spot temperature during the overload and (3) comparing these temperatures with those of Table 1 to determine the safety of the proposed loading.

Figures 1 and 2 are the fundamental curves on which the overloads for various times are based. Figure 1 is for self-cooled and water-cooled transformers; Figure 2 for forced-air cooled and forced oil cooled transformers.

Since these are general charts they can be used for any type of loading. If the load is changing continuously it can be approximated by a block curve in which the load remains constant for a short period of time, then suddenly changes to a higher or lower load, etc. By making the time subdivisions fine enough any load curve can be approximated.

To use the chart, start with a known oil rise or if necessary an estimated oil rise at the beginning of the load. Follow along the dotted line indicating the given oil rise to the curve marked with the number of times full load curve is the initial time. The time the load is to be carried added to the initial time is the final time. The copper rise on the times full load curve corresponding to the final time is the final hot-spot copper rise.

Table 7—Safe Gradients (Degrees C.) For Loading Purposes

Load (Times Full Load)	Self Cooled	Water cooled forced air, or forced oil cooled
1.0	25	30
1.1	30	35
1.2	35	40
1.3	40	45
1.4	45	50
1.5	50	55
1.6	55	65
1.7	60	70
1.8	65	80
1.9	70	85
2.0	75	90

Sample Solutions

To demonstrate the method of applying the various methods, the same problem will be worked by each. These methods are similar in principle and results but differ in details of application so each can be considered a separate method: The results will not be exactly the same for each.

Problem—A self-cooled transformer is to be loaded at 100 percent of rating for 22 hours followed by 130 percent load for 2 hours. The transformer is located in Milwaukee during a time when daily ambient is not to exceed 20 deg. C. Is 130 percent load for 2 hours safe?

Method No. 1—Assuming from Table 2 that full load oil temperature rise is 45 deg. C., the oil temperature after 22 hours will be 45 + 20 or 65 deg. C. Table 3 shows that 1.30 times full load can be carried for 2 hours if oil temperature doesn't go above 72 deg. C; thus this load can be safely carried until oil temperature reaches 72 deg. But the method doesn't give the length of time required for 72 deg. to be attained and so does not give a complete solution.

Method No. 2—Table 4 shows 1.25 times full load can be carried for two hours as a recurrent load with a 30 deg. C. ambient. From Table 5 this load can be increased 0.10 full load for an ambient of 20 deg. C. Thus the safe two hour recurrent load following full load is 1.25, 0.1 or 1.35 times full load. Obviously the proposed load can be safely carried.

Method No. 3—In Milwaukee, Table 8 shows the yearly equivalent ambient temperature as 20 deg. C. From Table 5 an increase of 0.1 × FL is permissible due to ambient. The daily load factor equals (2200 × 260) ÷ (180 × 24) or 0.79. From Table 6 the allowable load increase is 0.06 × FL. According to this method the permission load is (1.0 × 0.1 × 0.06) × FL or 1.16 × FL, which is less than the desired load.

Table 8—Equivalent Annual Ambient Temperatures

Atlanta	25
Bismarck	21
Boston	20
Chattanooga	24
Chicago	21
Corpus Christi	28
Dallas	28
Denver	23
Detroit	20
El Paso	26
Helena	20
Kansas City	25
Los Angeles	24
Louisville	24
Miami	28
Milwaukee	20
Minneapolis	21
New Orleans	27
New York	21
Oklahoma City	25
Philadelphia	22
Phoenix	31
Pittsburgh	23
St. Louis	25
Salt Lake City	22
San Francisco	19
Seattle	18
Washington, D. C.	23

Method No. 4—From Figure 1 (also Table 2) the oil rise following full load for 22 hours is 45 deg. C. The initial time for 1.3 times full load at 45 deg. C. oil rise is 3.5 hours. At two hours later or 5.5 hours the hot-spot rise is 84 deg. C. The sum of 84 and 20 is 104 C. This is less than the two hour temperature for recurrent loads given by Table 1 or 110 C. Consequently the proposed load can be carried safely.

Overloads should not be applied to transformers without a thorough study of various limitations involved, such as, oil expansion, bushings, leads, tap changers, etc. and the thermal capacity of associated cables, reactors, circuit breakers, etc. which may constitute the practical limit in load carrying ability.

In all cases it is good practice to check with the manufacturer before heavily overloading transformers.

Aid the War Effort Organize and Plan To Collect Waste Paper

Cable Trouble Caused by Spilled Chemicals

Ground on 2,400-volt distribution network serving industrial plant on Central Maine Power system located by audible type of fault analyzer and Murray loop test—Electrolytic action, accentuated by chemically saturated soil, found source of damage

NORMAN W. THURSTON, Central Maine Power Co., Portland, Me.*

DURING a periodic insurance inspection of the electrical equipment of a large industrial concern served by the Southern Division of Central Maine Power Co., a ground was discovered on the 2,400-volt, 3-phase distribution network which supplies energy from the main transformer substation to the various small distribution points of the customer. By segregating, the fault was traced to a conductor in one of two 2/0 parkway cables which operate in parallel and were buried an average of 3 ft. beneath a bituminous macadam mill yard through which the tracks of a local electric railway were laid. These tracks were in the nature of spurs and sidings serving the various buildings throughout the yard. The cables in question were varnished cambric with lead and a double steel tape armor, without jute on the outside. They had been in place about 20 years and when installed were laid in a bed of screened sand, covered with a layer of building paper about 3 in. above the cables and a 2½-in. reinforced concrete barrier cast in place in lengths of about 6 ft., and in widths of about 18 in. Near the substation there were eight cables laid side by side and spaced about 6 in. on centers. They dropped off in groups of two as each small distribution point was passed.

Fault Partly Located

Preliminary to locating the fault on the cable involved which was 821 ft. long, three test holes were dug, one near the main substation, one near the terminus, and one about halfway between. These holes were of sufficient length to permit the removal of one of the 6-ft. slabs. The sand cover was removed at these points to expose the cable, the appearance of which seemed normal considering the age and type of soil in which it was buried. At first a Lundin interrupter type fault analyzer was used, but it was found that the many possible return paths produced confusing signals. However, by using an exploring coil and amplifier, positive indications showed the fault to be in the half cable nearest the source. By the use of a recently designed triangle and amplifier, attention was drawn to a locality about 125 ft. from the source of power in front of a loading platform serving the dye house and directly beneath one edge of the railroad track. In the hope that the rails need not be disturbed, test holes were dug on either side of the suspected area. Readings taken at these points indicated that the fault was within the included 75 ft.

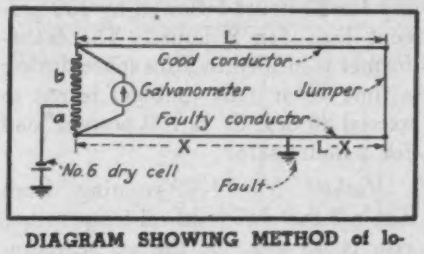


DIAGRAM SHOWING METHOD of locating faulty conductor on mill property served by utility company

with galvanometer at 0, $\frac{b}{a} = \frac{L+(L-X)}{X}$

or $X = \frac{2La}{b+a}$

L = length of cable
a, b = ohms of potential divider
X = distance to fault

Murray Loop

It was then decided to attempt to locate the point more exactly by means of a Murray Loop. This method had been attempted on previous occasions, but with very poor success due to the sometimes high or variable resistance of the fault and to the presence of moisture in sufficient quantities to product an electrolytic potential which gave an erroneous reading when the bridge was balanced. Wheatstone tests indicated the resistance of the fault to be about 2 ohms with no appreciable moisture present. In construction of the Murray Loop, the only materials at hand were a couple of potential dividers, one of them having a resistance of 10 ohms and the other having a resistance of 300 ohms. The instrument used as a galvanometer was a 75-millivolt meter contained in a Weston multimeter, the terminals of which were brought out. The accompanying sketch indicates the connections, the formula, and the method of use.

When a bridge balance had been secured, using the 10-ohm device, the equipment was de-energized and the value of the arms "a" and "b" were measured with a Wheatstone bridge. The resulting calculations showed the fault to be 116 ft. from the source of supply. This was checked with the

* Electrical Engineer, Superintendent of Station Repairs, Southern Div.

300-ohm potential divider and the results checked within 1 ft. Excavation was then undertaken at this point. It was necessary to saw the railroad ties and remove them in sections, and to support the rails by means of a scaffolding from which they were suspended. On reaching the concrete slabs, it was observed that one of them had become broken in the center. The reason for this became apparent by further digging which showed that at some previous time water had flowed transversely beneath the cables, thereby washing out the sand bed and permitting the cables to become deflected by the weight of the concrete slabs above them. When the slabs were removed the steel tape armor was found to be so badly corroded that it was completely absent for several feet.

Chemicals Plus Rain

At first this was thought to be due to electrolysis, but why it should concentrate at this point was a mystery until some samples of the surrounding soil were analyzed by the plant chemist, who reported a strong concentration of NaCl (common salt) and $Na_2SO_4 - 7H_2O$ (Glauber Salts). Conversation with the shipper brought out the fact that when unloading these chemicals from cars at this point, considerable quantities frequently were spilled on the ground. The action of rain caused them to be washed through the small crevice between the rail and the 3-in. macadam surface directly above the cable. Further examination showed the lead to be pitted and corroded, but no definite opening was observed. Consequently, a controlled alternating current of about 30 amp. was circulated through the fault and soon a hot spot could be felt. Continued passage of current burned a hole through the lead. Repairs were effected by cutting out about 35 ft. of the damaged cable and cutting in a new section using parkway splice boxes. New backfill material was provided and employees have been warned to avoid spilling chemicals on the ground. It is expected that other cables may give trouble at this point in the future, but lack of materials prevents present replacement of corroded portions.

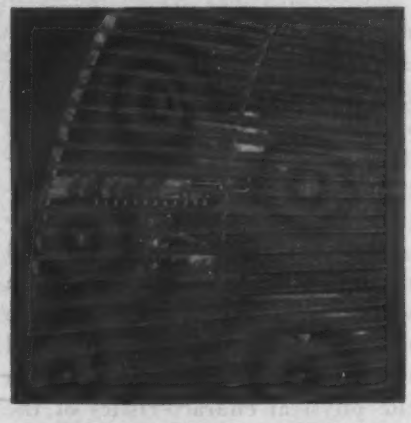
In conclusion it would appear that the cables were damaged by electrolysis accentuated by the chemically saturated soil.

Renew Stellite Strips on Turbine Blading

TURBINE WHEEL rests on special cradle in Columbia station turbine room

SURPLUS SOLDER AND OXIDE are ground from blade with air-powered wheel after worn stellite strip has been removed by melting the silver solder that fastened it to the blade

TINNED STELLITE STRIP, held by George A. Barnes (left), is ready to be placed. Flux and solder have been applied to the turbine blade and Charles P. Loomis is checking alignment of fusing materials. Clamp is used for preliminary setup only



A 12-FLAME TORCH is applied to assembly. Clamps hold stellite strips in perfect alignment until fusing is complete, to insure balance

Photos by Robert Lekker, Cincinnati Gas & Electric Co.

With 460,000 lb. of steam and 40,000 lb. of water an hour, at full load, passing through the last reaction stage blading of turbines No. 1 and 2 at Columbia Station even stellite tipped stainless steel blades begin to show signs of abrasive wear in time, and must be renewed. The blade area most vigorously attacked is about 10 in. from the outside circumference of the wheel. Accompanying pictures showing steps in the renewal process were taken at this Cincinnati Gas & Electric Co. generating station.

Each of the 232 blades in the last wheel are tipped with strips of stellite, a very hard alloy of tungsten, cobalt, and chromium with small amounts of nickel, manganese and iron. Though it cannot be drilled or cut with ordinary tools of high speed steel stellite can be ground when cold or sheared and punched at red heat.

To remove the alloy strips, silver solder that fastens them to the blade is melted. Then after old solder and any evidences of oxidation have been removed by grinding and polishing, new strips of stellite are tinned with silver solder. The blade surface is coated with flux, a thin strip of solder added and then more flux. The tinned stellite is finally put in place and clamped tightly. This mass is heated until the solder melts and fuses the metals together. Then, after finishing, the blade is ready for another tour of duty.

In units No. 1 and 2 at Columbia station, the last stage wheels carry a 9,000-kw. load while their 25 smaller companions carry a total of 54,000-kw. Thus it is important to keep them in top operating condition.

Speed, Load Control on Interconnected Systems—III*

Interconnection engineer discusses terminology, principles of governor action, desirability of linearity in response, and requirements of governors for interconnected system functioning—Concludes that the modern governing system, despite advances, is still inadequate

E. E. GEORGE, Electrical Engineer, Ebasco Services, Inc., New York

THIS ARTICLE DISCUSSES the characteristics of steam and hydro governors as applied to power systems. A future article will be devoted to the principles of electrical frequency control and electrical load control. Previous articles of this series have discussed the operation of the power system without control devices and the need for coordinating design and operation of control devices with the physical characteristics of the power system. Among such automatic devices, voltage regulators and speed governors are the most widely used and the best known.

•

IF THE CHARACTERISTICS of governors are such that these devices meet the requirements of modern speed and load control on interconnected power systems, this situation results largely from coincidence rather than from planning. General opinion among engineers is that steam and hydro governors of recent design and with good maintenance permit automatic control of frequency or tie line loading which is much better than manual control, provided the governors, synchronizing motors and valve mechanism are thoroughly tested and adjusted for overall coordination. This adjustment may include replacement of springs, cams, gears, resistances, etc., to get appropriate characteristics. However, it is a question whether the prospective development of higher speed systems of telemetering and load control may not create a demand for radically different governor designs, with faster speed of response and greatly increased linearity of control under conditions of variable load.

Governor Definitions

The reader trying to better his acquaintance with governors is likely to be confused by the wide variety of terms used by different authors to denote the same thing. Still more confusing is the use of one term to mean different things. For these reasons, many authors have prefaced their articles on governors with a set of definitions. Within the last few months the joint AIEE-ASME Governor Committee has produced a group of definitions that should promote common usage and understanding of the more important terms. Some of these definitions are:

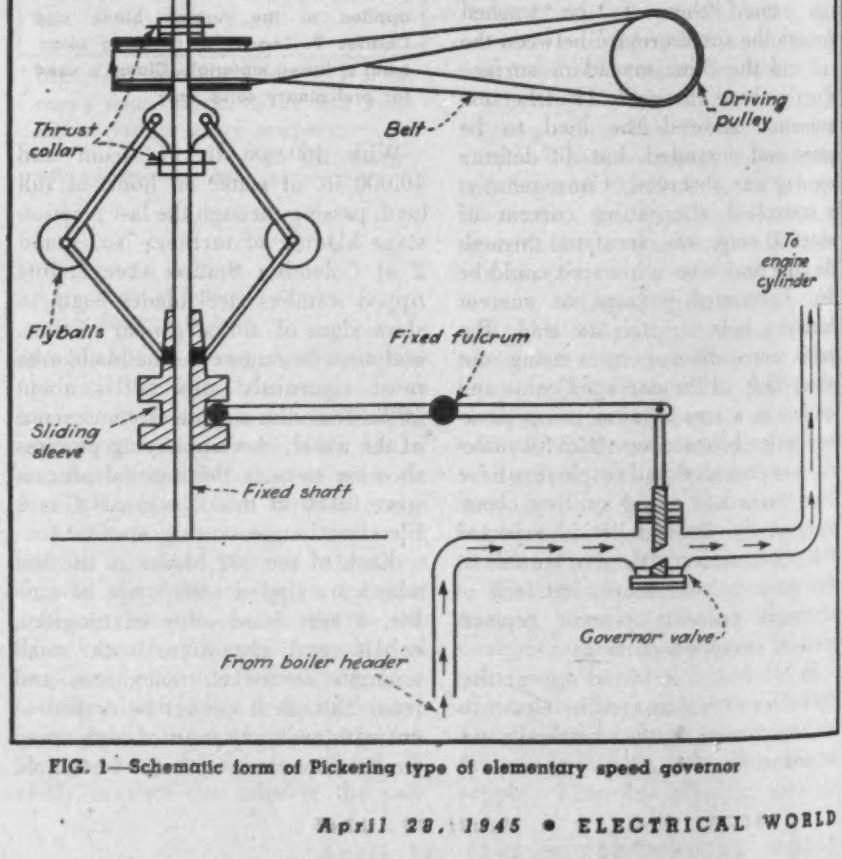


FIG. 1—Schematic form of Pickering type of elementary speed governor

* This series began in ELECTRICAL WORLD, March 17, 1945, page 84.

The *speed-governing system* includes the speed governor, the control mechanism and the governor-controlled valves.

The *speed-governor* includes only those elements that are directly responsive to speed and which position or influence the action of other elements of the speed-governing system.

The *control mechanism* includes all equipment such as relays, servo-motors, pressure- or power-amplifying devices, levers and linkages between the speed-governor and the governor-controlled valves.

The *governor-controlled valves* include those valves which control the energy input to a prime mover, and which are actuated by the speed-governor through the medium of the control mechanism.

The *speed changer* is a device capable of changing the setting of the speed-governing system for the purpose of varying the speed or the power output of the prime mover while in operation.

Other definitions used in this article are as follows*:

Slope, or *overall regulation*, is the change in speed, expressed in percent or rated speed, when the output is changed from rated power output to zero power output with the speed changer set to give rated speed with rated power output.

$$\text{Percent slope} = \frac{100 \times [\text{Speed at zero output} - \text{speed at rated power output}]}{\text{Rated speed}}$$

Rated power output is the prime mover nameplate rating in kilowatts.

Incremental regulation is the rate of change of speed with power output. It is usually approximated by measuring the amounts of speed change for a *small* change in power output, or vice versa, with the speed change set to give rated speed at the power output being considered.

$$\text{Percent incremental regulation} = \frac{100 \times [\text{Speed at lower power output} - \text{speed at higher power output}]}{\text{Rated speed}\ [\text{higher power output} - \text{lower power output}]}$$

The above calculation is to be based on *small* changes in speed and output.

Dead band is the total magnitude of the sustained speed change within which there is no resulting measurable change in the position of the governor-controlled main valves. Dead band is a measure of the insensitivity of the speed-governing system and is expressed in percent of rated speed.

Stability is the capability of the speed-governing system to position the prime mover governor-controlled valves so that sustained oscillations of prime-mover speed or prime-mover energy input are not produced by the speed-governing system during operation under sustained load demand or following a change to a new sustained load demand.

Basic Principle

Diagrams of governors are generally complicated by showing pilot valves, springs, dashpots, cams, oil piping, etc. Governor action is simply illustrated by the Pickering governor (Fig. 1), a well-known type used on small steam engines. The whirling of the flyballs causes them to rise until the centrifugal force balances the force of gravity (neglecting friction). The raising of the flyball sleeve partly closes the steam valve, thus lowering the speed. The result is that the speed is controlled within reasonable limits if the weights and levers are properly proportioned. Dashpots may be added to secure smoother and slower action on violent speed changes. Springs may be added to assist in opposing the upward motion of the flyballs and to provide adjustability. A compensator may be added to reduce overtravel and improve stability. To reduce the work done by the governor, the linkage may operate a small pilot valve. This pilot valve controls the steam valve through a hydraulic system using oil under high pressure. This is sometimes called a servomotor.

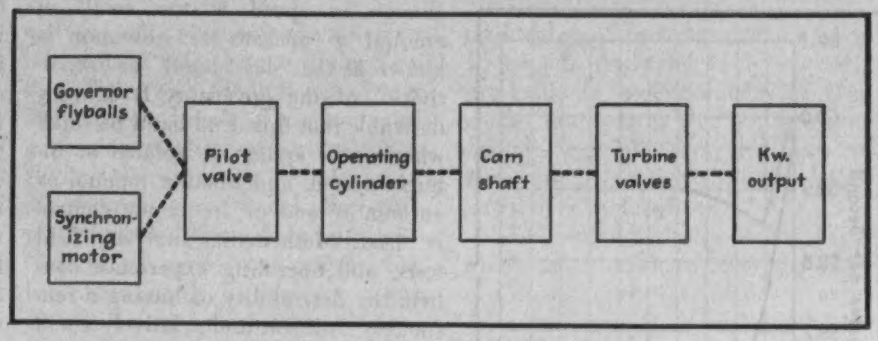


FIG. 2—Component functional elements of a turbine governor

To provide smoother speed control and better efficiency, large turbines are provided with several valves operated by cams (Fig. 2), instead of one large governor valve.

Importance of Compensator

Principle of the hydro governor is the same as of the steam governor, except that the compensator or restoring mechanism is more important, to reduce overtravel and instability, which would result from delays in governor action caused by inertia of water, penstock limitations, etc. The compensator moves the pivot or fixed fulcrum (Fig. 1) as the wheel gates move. If a speed reduction is required, the closing of the gates raises the fulcrum and neutralizes part of the flyball action. This correction compensates to some extent for the delay in speed correction and tends to prevent over-correction and instability. It thus introduces a new means of adjusting the governor characteristics to the plant limitations and load conditions.

Modern governors for large steam-electric or hydro-electric units are elaborate precision devices in many respects. Their sensitivity, accuracy, stability, and dead band are excellent. These characteristics are all related to sensitivity. They show great progress in the last twenty years, in common with other fields of engineering utilizing a small input from a control device to provide electrical or hydraulic multiplication to actuate massive machinery.

Desirable Linearity

Nevertheless, all governing systems today fail to meet the most important requirement of automatic control: linearly proportional change in power output with change in frequency or tie line loading. The average modern steam governor often varies as much as 1 to 3 in response, depending on the load on the unit and the resultant position of the valves, cams and springs. On a hydro unit, output is not linearly proportional to gate opening, especially in the 0 to 0.3 range and in the 0.7 to 1.0 range of gate opening. Even if the flyballs moved the governor arm linearly with frequency deviation, the main operating cylinder piston does not respond proportionately, due to valve lap, changes in oil pressure, etc.

The speed changer or synchronizing motor is frequently the poorest device that could be used for automatic control and even under the best conditions, it is inferior to the flyball mechanism in accuracy and adjustability. This is the primary reason why a governing system that works perfectly on an isolated plant or system is not always satisfactory when it is actuated by automatic control on an interconnected system.

Even if the main operating cylinder piston could be linearly controlled, turbine or water wheel output is not linearly proportional to movement of

* All of these follow closely the definitions of the joint AIEE-ASME Governor Committee.

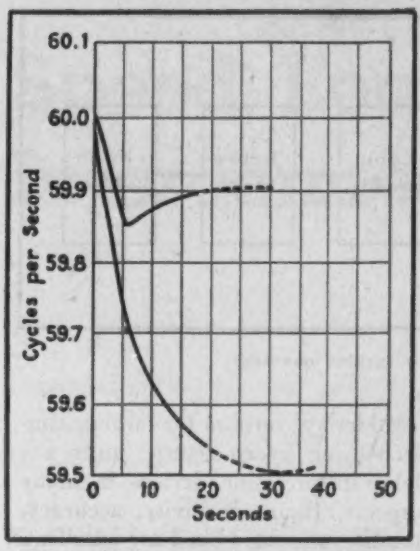


FIG. 3—Effect of governors on change in speed following instantaneous change in load of 2.7 percent. Upper curve is a record of test prorated to 2.7 percent load change with all governors in service; all units except one were carrying full load. Lower curve is record of test with all governors blocked

the valve or gate, due to pipe friction, changes in nozzle efficiency and blade efficiency, and variations in back pressure. All factors beyond the main cylinder could probably be controlled by a properly shaped master cam, but this complication would be of little help as long as there is no reasonably uniform relation between length of speed changer impulse and movement of the piston in the main operating cylinder.

The conclusion from the foregoing is that the modern governing system, compared with the past, is excellent, but judged by fundamental requirements, is still inadequate.

Action of Turbine Governor

Consider first the action of the ordinary steam governor, without manual or electrical assistance. If it is of recent design and well maintained, it may change steam flow for any sustained speed change of more than about 0.01 to 0.03 cycle (or 0.02 to 0.05 percent). The delay between initial speed change and initial output change may be less than 0.5 second for large changes, but it is likely to be several seconds for moderate or small changes. If the governor is of early design, it may not respond to speed changes of less than 0.09 to 0.12 cycle (0.15 to 0.20 percent).

The region where a sustained change in speed is too small in amount to operate the governor is known as the "dead band" or "sensitivity" of the governor. It is very desirable that this dead band be small whether the system is isolated or interconnected, and whether manual or automatic load or frequency control is used. Mathematic analysis, field tests, and operating experience confirm the desirability of having a reasonably uniform and relatively small dead band on all governors.

According to proposed specifications, dead band or sensitivity refers to sustained speed changes. In practice this band widens out as frequency changes become more rapid which is of particular importance on small or isolated systems where the maximum plant, load, or tie line which can be lost may be a large portion of total system torque and inertia. In such cases, the *rate* of frequency change is much faster than on large systems.

The usual frequency range of plus or minus 0.1 cycle on a large system will operate a good governor and it will respond in time to provide some correction to help out the frequency regulating plant. For a 0.1 cycle change and 5 percent governor slope, the kw. output will change 3 percent of full load, neglecting dead band. The effect of dead band may be to lessen the change in kw. output.

Time for Action

It is impossible for a governor to prevent a frequency change due to load change. What the governor does is to overtake the frequency change before it has proceeded very far, reverse it, and bring the frequency back most of the way to normal. The slope of the governor prevents a return all the way to normal; Fig. 3 illustrates this procedure. The data in this figure were taken from tests on a large system. Since the time-frequency curve due to sudden load change is an exponential curve (without governor action) and since the time frequency curve of governor response (to a new frequency level) is very irregular (due to time delay, friction, oil pressure rise, lap, governor inertia, etc.), the interaction of the two characteristics can produce almost any result, depending on governor design, setting and maintenance.

A good governor will correct a load change without serious oscillation and quickly settle down to a new speed, corresponding to the position on the slope curve for the load change (with due allowance for "dead band"). A poor governor will permit wider frequency change, or overshoot badly in correction, or oscillate for a long time, or even permit continued oscillation until a new load change occurs.

The time required for a good steam governor to correct a moderate load change seems to be about equal to the inertia time constant of the system, that is, 5 to 15 sec. If all governors are in service and set to a reasonable slope, the frequency band with good governor operation is only about 1/5 to 1/10 as wide as without governors, and the duration of frequency swings is only about 1/5 to 1/10 as long. Fig. 4 shows comparative values from an actual test.

Turbine Governor Test

Under the AIEE-ASME trial standards for steam-turbine governors of May 5, 1944, overall slope or overall

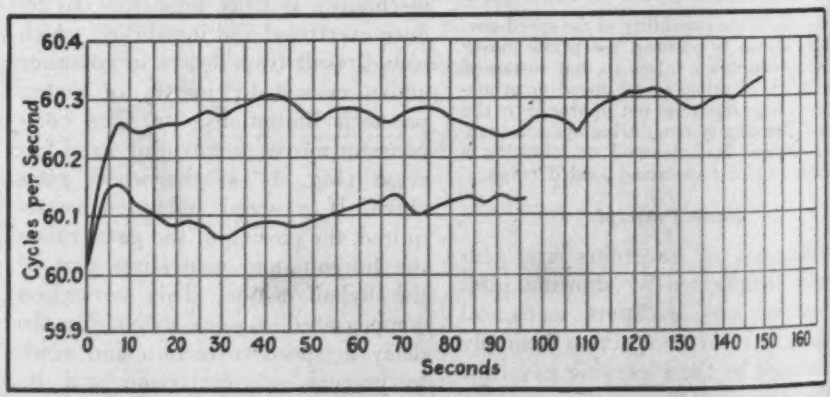


FIG. 4—Comparison of active vs. inactive governors; change in speed following instantaneous change in load of 5,500 kw. in each case. Upper curve: eight units fully loaded, one partly loaded. System load, 150,000 kw. Lower curve: eight units partly loaded, one fully loaded. System load, 135,000 kw.

Regulation is defined as the percent increase in frequency when a unit operated at rated frequency at full load (turbine nameplate kw.) has its external load reduced to zero without change in the loadspeed setting. The most convenient means of testing determines the same thing. To avoid actually dropping full load suddenly, the governor position at full load is marked on some reference scale, the load is gradually transferred to other units, and the governor of the unit under test is moved back to the full load position, with the unit carrying no load and disconnected from the system.

Incremental Regulation

The change between full load and no load is not a straight line, but varies with valve position. The slope at any point is called "incremental regulation" and may be 50 percent to 300 percent of the average value, even on modern units with many valves. (See Fig. 3-b in the above mentioned trial governor standards, or compare actual field test data on various units.) Overall slope or overall regulation is of little consequence in normal operation since under normal conditions all units are operating close to normal speed. Many of them are carrying full load and none of them less than minimum load. Therefore, incremental regulation in the neighborhood of rated speed and rated load is the vital factor in normal operation. Since incremental slope is not as easy to test, overall slope is usually specified and tested. The only way to change incremental slope (without a redesign of the governor and valve mechanism) is to change the overall slope (see Fig. 5). Thus, overall slope, although of little inherent value, is still the most popular and convenient measure of probable governor performance.

Recently the development and application of automatic tie line load control has focused attention on the performance of governors and on methods of determining this performance. One manufacturer recommends the following:

Incremental regulation is a measure of the relation between speed change and kilowatt change. This is made up of two components—one the amount of operating cylinder movement per unit of speed change for various positions of the governor, and second the change in kilowatts per unit of operating cylinder position. Thus, with the unit out of service you get a family of curves for the governing mechanism up to and including the operating cylinder showing percent operating cylinder stroke plotted against speed for several positions of the speed changing mechanism. This family of curves will provide sufficient information to determine the incremental regulation of the governing mechanism alone. With the unit connected to the system, a curve can be plotted showing kilowatt output vs. operating cylinder position. By combining these two sets of information the incremental regulation of the governing mechanism and the inlet valve can be reasonably accurately obtained.

Governors are sometimes equipped with accessory devices for blocking travel in either direction, or for blocking travel in an opening direction, or for preventing operation on small changes.

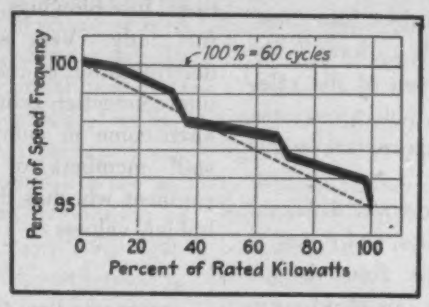


FIG. 5—Typical slope or regulation curve for 3-valve steam turbine governing mechanism. Dotted line shows nominal, overall or rated regulation. Shaded area indicates incremental regulation, varying with valve opening. (illustrative only). In practice these lines are curves and if they slope upward in any section, instability prevails in that load range. Vertical width of shaded area indicates dead band (illustrative only)

On account of the high centrifugal stresses in steam turbines and generators, automatic overspeed trips are always provided with a setting of about ten percent.

Action of Waterwheel Governor

A hydro governor of recent design and well maintained will change water flow for a frequency change of 0.01 cycle, with a droop of $\frac{1}{2}$ of one percent. With higher droop, the sensitivity is poorer, although better than on steam governors. The long time delay of hydro-governors (2 to 10 sec.) is partly due to the necessity or avoiding waterhammer in penstocks and partly due to the large energy multiplication required to move simultaneously the many heavy gates of a waterwheel.

The modern hydro governor, being much more sensitive than the modern steam governor, tends to assist frequency regulation on more of the small changes, provided these changes are sustained for several seconds. On large changes, hydro governors frequently tend to operate at cross purposes with steam governors, due to the faster response of the steam governors. Electrical controls can be set to reduce or eliminate this difficulty.

Small "dead band" is just as desirable in a hydro governor as in a steam governor. The efficiency curve of a hydro unit is generally less flat than on a steam unit, but the loss due to assisting on frequency swings with plus or minus 3 percent output change (with 5 percent slope and .1 cycle range) is negligible.

Standardize Specifications

The question may be raised as why a steam governor could not be made as sensitive as a hydro governor and still retain the small time lag possible with the steam governor. There seems to be no inherent reason why this could not be done. The steam governor is usually bought as an accessory from the turbine manufacturer, sometimes without specification, generally without ready means of adjustment, and without quantitative test. The hydro governor is frequently bought separately, on specification, and subject to severe acceptance tests. It is also provided with slope and sensitivity adjustments which can be changed (by dial settings) while the machine is carrying load. It appears from such considerations that it would be very desirable to standardize hydraulic and steam governor specifications as much as practicable. The new trial standards for steam governors are a definite contribution to progress.

Droop correction or automatic compensation is a necessary feature of hydro governors. The low speeds of most hydro units permit runaway without much danger to the power plant, and over-speed trip devices are sometimes omitted from hydro governors.

Editorials

S. B. WILLIAMS, *Editor*

Talking Load Building vs. Actually Building Load

"I WISH some way could be found to inject into these salesmen some of the optimism they ought to have." By "salesmen," the speaker meant the top men of the sales department of a particular electric utility, but in response to a question he allowed as how maybe his remark might be stretched to cover the whole industry.

It was not a banker, thinking about post-war dividend possibilities, who so expressed his feelings. Nor was it a top utility executive, concerned with the future of his company. Neither was it a manufacturer, his mind occupied with thoughts of the market for his product.

It was an engineer who spoke. In his position of responsibility for certain aspects of system design, this engineer had studied seriously the post-war potentialities of electric service. He had participated actively in the post-war planning of his company. In his literal engineering way, he had believed what he was told about pent-up buying power, about a market hungry for electrical services and goods after being starved through the war years. He had seen, and had taken seriously, surveys of customer desires for electric ranges, water heaters, refrigerators, home food freezers and all the rest of the appliances represented in the picture of electrical living. On the basis of this appraisal of post-war prospects he was busy with plans for additions to substation capacity, for strengthening transmission facilities and for improving distribution lines and networks.

And now, with the time apparently close at hand to place orders for equipment and materials for system rehabilitation and reinforcement, this engineer was finding that the "salesmen" didn't exactly mean all they had said about load growth after the war. At least they were not ready to say that load would be built so fast and in such big chunks as he, in his innocence, had believed. He was discovering that what he had thought was serious planning for immediate post-war activity was only the "talking big" to which the expansive salesmen nature is prone, or at best the contemplation of a comfortable long-term prospect that would not require too much hard work from anybody.

This, of course, might be an isolated example but it did cause one to wonder if many other load building plans were built in the same way.

Statistical Mathematicians

UTILITIES keep operating records for day-to-day and year-to-year guidance, but many times these data contain a wealth of additional information of usefulness in other directions. The reason this supplementary information is not recognized is that those who compile and interpret it are not trained analysts. It takes a mathematician or statistics expert to sense these hidden indexes and to bring them out into the open where they can render further service.

Every utility of any size at all should plan to have a staff member to whom the statistics of household consumptions, fuse blowings, pole life and what-not can be referred for study. Very significant results in forecasting, in determination of reserves, in gearing for best station and interconnection economy and in choice of breaker ratings have come in companies that are blessed with special staff members or with the occasional departmental engineer who has that peculiar aptitude for ferreting out hidden values.

Wind Power Still in the Running

THE RECENT MISHAP at Grandpa's Knob, location of experimental Smith-Putnam 1,000-kw. wind turbine installation which has attracted such wide engineering attention during the past few years of pioneer development, need not be regarded as conclusive evidence that such projects are to be classed as physically impracticable. The loss of one of the two propellor blades, apparently from a concealed crack in the metal near the roof, is most regrettable, coming as it did within about three weeks of the resumption of operation of the unit after a long period of standstill required in connection with the replacement of a bearing and other mechanical improvements. This distressing event, however, has been accepted by the sponsors of the undertaking as a challenge to further metallurgical investigation. Their announced determination is to restore the unit to commercial operation as soon as war priorities permit.

It should be remembered that practically all of the operating experience at Grandpa's Knob has been gained since Pearl Harbor and that war conditions have greatly handicapped progress in the development, here as in many other fields not immediately connected with hostilities. There have been notable periods during which the

unit has delivered substantial amounts of energy into the Central Vermont Public Service system on satisfactory schedules of operation, even under wind velocities of 60 miles per hour or over. Mechanical rather than electrical problems have occupied designers and builders of this remarkable installation since it first went into service in late 1941. In general it appears that the problems of control, both electrical and mechanical, have been effectively solved. Immediately successful design and construction in so new a field is an admittedly large order; but one cannot observe the results already attained on Grandpa's Knob without the conviction that here is something to be reckoned with in the technique of future power production, whether by adjustable blades or by some other means of maintaining synchronization of a wind-driven prime-mover with established power systems.

Design Responsibility to Be Returned to Industry

ONE OF THE IMMEDIATE RESULTS of removal of limitation orders come V-E Day will be the return of construction design responsibility to industry. Stern necessity to conserve every possible pound of critical materials placed OWU and its predecessor in the position of having to study every project submitted to see if perhaps some alternate design might not be more economical in the use of copper or iron or other short material. Obviously, as this continued, more and more reliance was placed upon the OWU engineers until they frequently were making decisions that the companies might just as well have made for themselves.

While there probably were some utilities that imposed on OWU for design decisions, in general the whole scheme of operations developed out of a feeling of confidence in OWU and a mutual desire to cooperate. This team work which existed between the power industry and its branch in WPB has not gone unnoticed in Washington.

When the controls are removed after V-E Day, OWU will still help companies to get priority assistance when there is a war need, but with materials again in plentiful supply there will no longer be any necessity for deciding between projects on the basis of material economy or for making any design suggestions. Utilities will henceforth have to make their own decisions and with the knowledge they will have to live with them.

Another change that will come with the removal of restrictions will be the shift in relations with suppliers. During the three years or more of priorities the old buyer-seller relationship underwent many changes, all of which will now have to be changed back. In not all cases can the change be made as quickly perhaps as one would want because many manufacturers will still have some part of their output in war work which will have to take precedence. Where for that or other reasons, manufacturers are unable to give as fast deliveries as are desired, patience is urged. If priorities are sought and secured in other than the most exceptional cases it will simply stretch out the standing-in-line time and retard the return of full supplier responsibility. In a free or nearly free market the buyer will find as a rule that the salesman will do everything possible to take care of a customer. Priorities will relieve the salesman of that responsibility toward the customer that has sought to advance his place in the line.

While the assistance of OWU will probably be available so long as this country is at war most utilities will probably want to "walk by themselves" just as soon as controls are removed. As fine as the relationship between OWU and the industry has been, most operators are going to find it rather good to be entirely on their own again.

Fluorescent Complaints

COMPLAINTS OF EYE TROUBLE and discomfort caused by fluorescent lighting continue to be heard, in spite of the fact that no research as yet has been able to prove that there is in any injuries ultra-violet leakage from such a source. In almost every instance where anyone has made an effort to get at the source of trouble it has been found that the problem was one of glare and not type of source. Fluorescent lamps are low in brightness as compared with incandescent lamps but not so low that they can be placed in the line of vision without proper shielding.

Where formerly people complained of headaches because they were not getting enough light they are now complaining of the same ailment because they are getting too much light. The answer, of course, is not to reduce the amount of light but to make the corrections necessary to improve its quality.

Users cannot understand these complaints because they have installed what they were told was real good lighting —thirty-five or forty or more foot-candles. In a great many instances the fault can be laid on the doorstep of the lighting fraternity because it got in the habit of appraising jobs purely on the basis of foot-candles.

High intensities, even higher than today's levels, are desirable, but they cannot come until accompanied by engineered design that takes all of the quality aspects of lighting into consideration. It will be easily possible to give high intensity fluorescent lighting a reputation that it would have difficulty living down, especially if the post-war period brings a large number of opportunist manufacturers and salespeople.

Everyone who lays out lighting work should be cautioned to make sure that the quality will be top grade even if it means that the foot-candles have to suffer somewhat. And since quality is of such paramount importance and so few people really understand it, everyone engaged in the selling and installation of lighting, as well as designing, should be encouraged to take one of the available courses.

The industry must be prepared to give the public good lighting in every respect, but to do it the rank and file of customer contacts must know a whole lot more about quality than they did before the war started.

WASHINGTON COMMENT

By R. N. LARKIN, Washington Correspondent

Where Does Truman Stand on Public Power Program?

WHERE PRESIDENT TRUMAN stands on the issue of public versus private ownership of electric power is not easy to determine.

While there is a wealth of evidence that he is not opposed to public ownership, per se, there is very little to indicate that he was acting other than as a good party man.

Since Mr. Truman's position on the issue is of interest primarily because of his influence on federal power policy, and since, for practical purposes, federal policy of public ownership and development dates from the first administration of the late Franklin D. Roosevelt, it seems logical to assess Mr. Truman's position on the matter in relation to that of the late President rather than solely on the abstract public-private issue.

In other words, will Mr. Truman push the expansion of government power to the same or lesser degree than did Mr. Roosevelt? Since he never apparently was a zealot on the side of government power, he can hardly be expected to go beyond the Roosevelt program and might easily fall short. All that there is to go on are a few statements and a very colorless Senate voting record.

Will Continue Program

In his first Presidential press conference last week, Mr. Truman was asked whether he would continue the public power policies of his predecessor. According to an official transcript, he replied, yes, wherever possible and necessary.

This statement, under the circumstances, must be considered as basic in any evaluation of the President's position on public power. Since he declined to answer certain questions —among others his position on the St. Lawrence Project and the re-appointment of TVA Chairman David Lilienthal—the statement indicates that Mr. Truman does not regard the question of public power as a political one or as one open to much debate. That he answered it directly instead of referring the questioner to his Senate record—as was the case with one highly explosive question—indicates that Mr. Truman is neither afraid of the question nor of the reaction his answer might be expected to raise.

The Senate Record

An examination of Mr. Truman's Senate record on eleven power issues which were of more consequence than many others which arose during the decade starting in 1935 is indicative but not conclusive. He failed to vote on the Public Utility Act of 1935, embodying the holding company act and what is now the heart of the Federal Power Act, although "If present, he would have voted yea."

He voted pro-public-power on the "Public Utility Amendment" to the 1938 work relief bill by opposing an amendment prohibiting PWA loans for income-producing projects which would compete with established public utilities whose rates are satisfactorily regulated. He favored public ownership again by voting for enactment of the bill. A third power issue in this legislation, a Senate amendment cutting from $100,000,000 to $25,000,000 the single-year loan funds authorized for REA, was defeated by voice vote, with no record of Mr. Truman's position, although he probably opposed the amendment.

He did not vote on the "Bailey Amendment" to the flood control bill last November, under which federal power policy would have been revised in a manner vigorously opposed by public power senators.

On the other six power issues considered here, no specific record of Mr. Truman's voting is available, since all were passed in the Senate by voice vote. On the basis that he generally was an administration man in the Senate, however, it is not inconceivable that he voted pro-public-power on each. The issues were: The statutory creation of the Rural Electrification Administration; the Bonneville Project Act, a cornerstone of federal power policy; The Fort Peck Act, which extended that federal power policy; two amendments to the TVA act, one allowing TVA to purchase Commonwealth and Southern properties, the other boosting the amount and spelling out the method of TVA payments in lieu of taxes; and the Pace bill, which extended the life of REA indefinitely and liberalized terms governing repayment of REA loans.

Position on MVA

Mr. Truman's record on the Missouri Valley Authority, which in present form is a public power bill from start to finish is more revealing. On numerous occasions, Mr. Truman has supported an MVA. The St. Louis Post-Dispatch, one of the most ardent MVA supporters, published, last March 2, an interview in which Mr. Truman declared that development of the Missouri Basin represents the country's greatest opportunity today, that the development plan should differ considerably from that of TVA, and that an MVA similar in principle but differing in detail from TVA and headed by Brig. Gen. Lewis Pick, of the Army Engineers, would have his support. Pointing out the dominance of power in the TVA setup, Mr. Truman told the Post-Dispatch that the Missouri as a whole is not a power river. Those power sites which exist on its upper reaches and tributaries, he said in the interview, should be public owned and developed and not allowed to fall into the hands of private interests.

As President of the Senate, Mr. Truman referred to the Commerce Committee the MVA Bill introduced by Sen. James Murray, Montana democrat. This was fought bitterly by Senate public power men who feared the bill would be buried there. The issue was settled, after Mr. Truman refused to re-refer the bill, by a compromise which probably will prevent the MVA bill from being acted upon this year.

NEWS OF THE WEEK

Horan Bill Provides New Type of Valley Authority

Columbia Valley Cooperative Authority Based on TVA but Has Radical Differences—Local Control Is Provided by Advisory Council of State Governors and Commissioners—Payments in Lieu of Taxes High

The latest thinking in regional authority bills was revealed to Congress last week by Rep. Walt Horan, Washington Republican, in a measure to establish a Columbia Valley Cooperative Authority.

In large part the Horan Bill is based on the Tennessee Valley Authority Act, but in numerous respects, it differs radically from the prototype of river valley development authority legislation.

Purpose of the Horan Bill is to encourage and provide for, among other things, "power development and utilization." The Authority is to be controlled by five directors appointed by the President for seven-year terms. Four of these are to be recommended by the Governors of Idaho, Montana, Washington and Oregon. Annual salary is to be $15,000.

Created with the board of directors is a Columbia Valley Advisory Council, its members to include governors of the four previous mentioned states and members of state Columbia Basin commissions which the Horan Bill asks the affected states to organize. In addition, the Director of Conservation and Development of Wyoming would be a member. No proposal by the Authority for development of the region could be sent to the President or Congress until submitted to the Advisory Council for its views which would have to be transmitted to the Federal Government along with the plan.

The Authority is directed to formulate and present to the President and Congress as soon as possible "proposals for carrying out the purposes of the act. They would become effective if not affirmatively disapproved by Congress within four legislative months after their submission. The Authority would be bound to recognize existing water rights and laws and would be required to recognize the doctrine of the beneficial consumptive use of water, making water available, in case of dispute, for domestic, irrigation, mining, industrial, flood control, navigation and power development purposes in that order. Power and water projects would have to be collectively self-supporting and self-liquidating."

The Authority could build, acquire and operate those things it found to be necessary or appropriate and could acquire property by purchase, lease, condemnation or donation. It could not acquire the electric properties of any state political subdivision which opposed such acquisition except in specifically stated cases. It would be authorized to produce, transmit and sell electric power and engage in other activities. It could enter into such contracts and agreements and do such things as might be necessary or appropriate.

As soon as the Authority is established and operating, it would take over the Bonneville Dam and transmission system and all property, personnel and funds of the Bonneville Power Administration, and the Bonneville Project Act would thereupon be repealed.

In its power business, the Authority would have to give priority to public and cooperative purchasers and assist them in acquiring distribution systems. It could assist potential energy purchasers in constructing or acquiring systems, in organizing public and cooperative systems and in financing them. It could stipulate resale provisions in wholesale power contracts and would be required to publish rate schedules "necessary or appropriate to provide adequate markets and outlets for electric energy and to encourage the widest possible use of electric energy." Rate schedules "shall have regard . . . to the recovery of the costs of generating and transmitting such electric energy, including appropriate reserves for maintenance and upkeep . . ." and for amortization.

Net profits, after operating costs, financing costs and a contingency fund not to exceed 10 percent per year, would go into the U. S. Treasury.

The Authority would be authorized to issue revenue bonds all charges of which would be payable only from Authority revenues and which would not be guaranteed by the U. S. Necessary appropriations by Congress are authorized.

Would Prevent Tax Loss

One of the principal points of difference between the Horan Bill and the TVA Act is in the former's provision for payments in lieu of taxes.

The Authority would be required to make such payments in lieu of real or personal property taxes on any electric system or other acquired property, to make payments in lieu of business, franchise and other similar state and local taxes allocable to any electric distribution or related facilities acquired and operated by it, and to make payments in lieu of taxes whenever it found that the tax revenues of any state, county, district or other taxing unit "have been substantially affected by the acquisition of real or personal property or any interest therein . . ."

This latter requirement would apply only when such tax loss had not been offset "by gains derived by that (taxing) unit from the operations of the corporation. . ." Payment would equal the amount of the loss over the gain resulting from Authority operations in

the taxing district. No method is specified to calculate such gains. These payments in lieu of taxes would be equal to the average amount of taxes paid on the property concerned during the last three years it was privately owned before it was acquired by the Authority.

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Rocky Mountain League Backs Utility Cooperation

Post-war problems and cooperation of all utilities, both business-managed and municipally owned, in solving them were the main topics at the spring conference of the Rocky Mountain Electrical League, April 19-20, at Denver.

Principal objective of utilities in the association is to promote industrialization as they are faced not only with a decrease in load when the war ends but also with the additional power which will be provided by the Colorado River-Big Thompson project of the Reclamation Bureau which is scheduled for completion in 1946.

Executives of seven communities operating municipally owned power plants were present at the meeting and President F. F. McCammon pointed out that both municipals and private utilities face the same problems, both have the same bottlenecks on maintenance materials and labor, both seek solutions to the competition by the government in their common field of operation.

A decision to consolidate all data concerning union labor contracts and to attempt to coordinate such information with regulations issued by federal bureaus controlling electric utility operations, was reached.

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Tornado Topples Cooling Tower, Interrupts Service

Electric service in Helena and Marianna, two eastern Arkansas towns operated under lease by Arkansas Power & Light Co., was interrupted, April 16, when a tornado downed the power plant cooling tower there. In falling the cooling tower guy wires pulled down a 2,300-volt line extending from the plant to the substation, which serves Helena and the nearby town of Marianna, which is fed by a transmission line. The coal-fired generating plant was put out of service for several hours before temporary repairs could be made to handle condensing water. The Helena-Marianna system was leased by A.P.&L. a year ago, and two 110-kv. transmission lines, one from Mississippi and the other from Pine Bluff, are now being constructed to tie the system into the A.P.&L. interconnected system.

Illinois Tech Installs Network Calculator

17 Midwestern Companies Including 11 Utilities Sign for Time—Operating Staff Announced

Seventeen Midwestern companies, including 11 electric utilities, have purchased time on a unit basis for the use of the new $80,000 a.c. network calculator which has been installed at the Armour Research Foundation of Illinois Institute of Technology.

Circuit elements on the calculator, which was purchased from Westinghouse Electric & Manufacturing Co., are available to represent simultaneously 12 generating stations, 100 transmission lines or transformers, 40 loads and 18 variable radio transformers. Engineers analyzing power system operation can, from readings on the board, determine the effect of additional loads, methods by which additional loads may be carried, or the system changes that can be made.

The laboratory staff will consist of Dr. W. A. Lewis, former consultant to electric power systems in New England and the Pacific Coast for Westinghouse, adviser; Lester B. LeVesconte, for 18 years with Westinghouse, supervisor of studies and chief engineer; and Dr. L. T. Rader, director of the department of electrical engineering at Illinois Tech, director of educational functions in connection with the board studies.

Mr. LeVesconte will be assisted in the study of power system problems by the Westinghouse fellow in power systems engineering, appointed by Tech and the Westinghouse Educational Foundation, and by senior and graduate students at the Institute.

Several weeks of time in each year may be available to companies not included in the sponsor group.

The 17 companies which have contracted for one unit of time which permits the use of the board for one week of each year for 12 years are Wisconsin Electric Power Co., Wisconsin Power & Light Co., Wisconsin-Michigan Power Co., Wisconsin Public Service Corp., Wisconsin Gas & Electric Co., Interstate Power Co., Iowa Electric Light & Power Co., Iowa-Illinois Gas & Electric Co., Kansas Gas & Electric Co., Ohio Public Service Co., Otter Tail Power Co., United Light & Power Service Corp., Sargent & Lundy, Allis-Chalmers Manufacturing Co., Carnegie-Illinois Steel Corp., Inland Steel Corp., and Illinois Institute of Technology.

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Cleveland Municipal Can Cut Production Costs If—

Cleveland can reduce the production cost of power generated in its municipal plant if those responsible so desire, A. C. Kirkwood, Burns & McDonnell Engineering Co., asserted in a letter to Utilities Director Emil J. Crown.

The letter was the reply to the report of Edward J. Kenealy, engineer in the city's Division of Light & Power, (ELECTRICAL WORLD, April 21, Page 9) criticizing a report on the municipal system made by the engineering firm, revealing that production cost for the municipal is 6.2 mills per kw.-hr. as compared with 3.2 mills for the Cleveland Electric Illuminating Co., and advocating that the city purchase power "wholesale" from the business-managed utility.

Mr. Kirkwood pointed out that in Springfield, Ill., costs were 3.3 mills per kw. hr. in 1944 and said that "With C. E. I. and Springfield municipal plant costs similar and below the Cleveland municipal plant costs, it is self-evident that the Cleveland costs are out of line."

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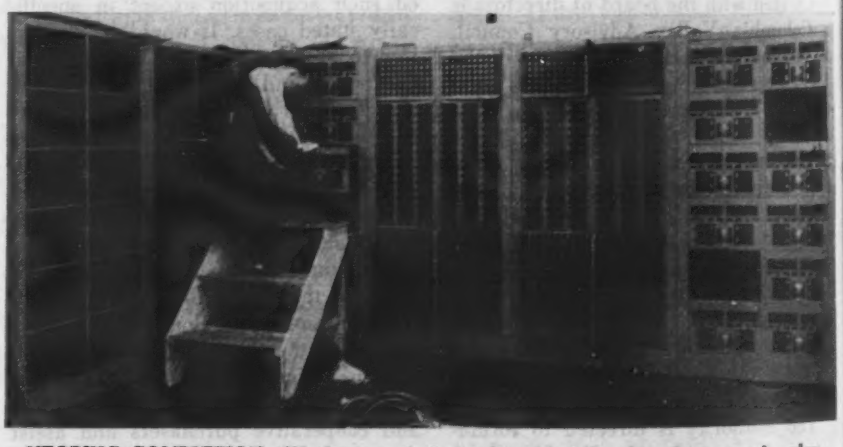

NEARING COMPLETION—Workmman makes adjustments to the a.c. network calculator at Illinois Institute of Technology which will be used to analyze difficult problems in power system design and operation

MVA Meets Opposition at Subcommittee Hearing

Witnesses Agree Only That Federal Government Should Invest Large Sums of Money for Water Control and Power Development—Ickes Advocates National River Development Board over Murray Proposal

The Missouri Valley Authority bill introduced by Sen. James Murray, Montana Democrat, faces a rocky road when it reaches the floor, it became apparent last week as both the Army Engineers and Interior Secretary Harold L. Ickes opposed the bill in hearings before a hostile subcommittee of the Senate Commerce Committee.

About the only point on which witnesses and the committee were in agreement was that large sums of federal money should be invested in water control and power development facilities on the Missouri River, and beyond that point, it was every agency for itself on the question of which should hold jurisdiction.

C.I.O. Witness Backs Plan

Subcommittee Chairman John Overton, Louisiana Democrat, continued the critical tone adopted during first day hearings by other committee members when he clashed with CIO witness John Brophy as to the effect of the Murray bill on local autonomy. Sen. Overton said the bill gave MVA such broad powers as to subordinate all local authority, while Brophy, who favored the measure, said "it would give the people authority" over flood control, irrigation and other matters of public concern. He said there must be a single agency, in the affected locality and endowed with authority to do its job.

Sen. W. Lee O'Daniel, Texas Democrat, declared that, carried to its logical conclusion, the proposal would set up a government of regions defined by the borders of river valleys in this country.

An indication of the split in sentiment on Murray's MVA proposal in the valley itself came when Brophy said the inhabitants of the region "are of the opinion that an overall plan such as the Murray bill would be best."

Sen. Edward V. Robertson, Wyoming Republican, disputed the statement, whereupon Brophy declared that "the people we've contacted want it."

"The people I've met are against it," Robertson asserted.

Ickes took the stand to deliver criticisms which Sen. O'Daniels said "in effect, killed the Murray bill." Ickes endorsed the establishment of an MVA, but said the Murray bill was no way to do it. He declared that the problem is not merely the establishment of a regional development authority for the Missouri River valley, "for Congress will not do less for one watershed than for another." The Murray bill, he said, sets up an MVA and stops there, ignoring "all citizens in all valleys, other than the Missouri Valley, who believe that a valley authority would be of benefit to their respective regions. It does not meet the problem with which the Congress is really confronted."

Further, Ickes declared, the Murray bill provides no coordination between various valley authorities.

Ickes then plumped for his proposal of a National River Development Board, before Congress indirectly now as a part of the Columbia Valley Authority bill introduced some months ago by Sen. Hugh Mitchell, Washington Democrat. Such board would be composed of the Interior and Agriculture secretaries, the chief of Engineers, and administrators of all valley authorities, and would govern authority policy and operations.

Ickes flatly opposed the autonomous three-man board proposed by Murray to operate MVA, saying it would lead to a quarrel if equally strong men were members of such board, or would result in one-man control. One of the most important lessons taught by TVA, Ickes declared is that "time, money and manpower can be saved if future authority legislation incorporates some element of compulsion to insure efficient collaboration between authorities and the rest of the federal government."

Equally imposing opposition to the Murray bill as that presented by Ickes came as Maj. Gen. Eugene Reybold, chief of Engineers, told the committee that the Murray bill would hamstring navigation and flood control in that basin and in others.

"If the Army Engineers are to meet their responsibility for flood protection in the lower Mississippi Valley," Gen. Reybold asserted, "they must have full and complete control of flood control dams in the Missouri Valley."

Gen. Reybold added that such construction programs as MVA would control under the Murray bill are training schools for the Corps of Engineers, and that MVA control of them would reduce peacetime strength of the corps and endanger its ability to expand fast enough to meet war demands.

EMBLEM FOR EMPIRE WINS BOND—Winner of a company-wide suggestion contest conducted to pick a new emblem for The Empire District Electric Co., Joplin, Mo. was Don C. Henshaw, distribution department workman, who is shown, right, receiving a $100 war bond from James E. Harsh, president. Henshaw holds the new company emblem he designed

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Army, Navy Bring Truce to Delay California Strike

Hostilities which threatened to culminate in a strike of nearly 4,000 AFL electrical workers employed by the Pacific Gas & Electric Co. throughout northern and central California, April 19, were held in abeyance until May 19 by a truce negotiated by the Army and Navy.

Intervention of the government forces came two days before the scheduled walkout of International Brotherhood of Electrical Workers employees in nine P.G. & E. divisions following a strike vote held under supervision of the National Labor Relations Board early in April. (ELECTRICAL WORLD, April 7, Page 9.)

Asserted Regional War Labor Board delays in settling a wage dispute precipitated the action, while WLB assurance to the Army and Navy that settlement would be expedited prompted postponement of the strike.

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Tidewater Sells Buses

Tidewater Power Co. has been authorized by the North Carolina Utilities Commission to sell its transportation facilities at Wilmington to the Safety Transit Co., a new corporation, for $150,000. The purchase price includes bus equipment and all franchises.

Senate Amendment Gives REA Added Loan Funds

Conference Committee Studying Measure to Increase REA Loan Funds from $60,000,000 to $125,000,000—Eight Senators Introduce Bill to Give Reclamation Bureau Authority to Improve Colorado River Basin

A Senate-approved amendment to the Agriculture Appropriation Bill for the fiscal year ending June 30, 1946, and increasing from $60,000,000 to $125,000,000 the loan funds authorized for the Rural Electrification Administration was before a conference committee this week.

The amendment, proposed by the Senate Appropriations Committee, was accepted by the Upper House without debate. It provides also that $35,000,000 of the authorization shall be available immediately as an additional fund for the current fiscal year ending next June 30.

REA's administrative appropriation was increased from $3,150,000 to $3,330,000 by another amendment accepted by the Senate.

The increased loan fund authorization was $25,000,000 below the amount recommended by the Budget Bureau in submitting the bill. Efforts to get the House to agree to the figure, after its Appropriations Committee had decreased the authorization to $60,000,000 were unsuccessful.

Broad legislation authorizing the Bureau of Reclamation to construct in the upper basin of the Colorado River "reservoirs and related work . . . sufficient to equate the flow at Lee Ferry to assure compliance with the Colorado River compact . . . and to support and facilitate the administration of the water utilization treaty with Mexico . . ." was introduced by eight upper basin Senators.

The Bureau of Reclamation currently is completing a program to carry out these purposes in which it appears that only a very small amount of hydroelectric power is contemplated. One 1,500-kw. plant would be installed at the proposed Elkhorn project to utilize a 530-ft. head for the generation of 9,390,000 kw.-hr. yearly. Another power plant would be installed on the proposed Cokeville project, utilizing a drop of 200 ft. to generate about 45,000,000 kw.-hr. annually. In addition, water diverted through the Bear River Channel to serve lands in Box Elder County, Utah, would be used at the Soda, Grace and Cove plants of the Utah Power & Light Co.

Legislation to carry out the disposal program suggested by Bonneville Power Administrator Paul Raver for federally owned aluminum and alumina plants was introduced by Rep. Hugh DeLacy, Washington Democrat. It provides for the appointment of an administrator of light metals who shall have charge of aluminum procurement for war and who shall assist in the disposal of surplus aluminum and alumina plants. He would be required to maintain economic government plants in operation until their disposal, cancel leases now held for operation of these plants by the Aluminum Co. of America and replace Alcoa with competitive private management, and review and revise all existing contracts for aluminum procurement held by the Metals Reserve Corp.

The DeLacy Bill embodies the suggestions for disposition of federal aluminum properties suggested by Raver in hearings before the Senate Small Business Committee. Raver's testimony made it evident that BPA is dependent in large part on continuation after the war of extensive aluminum production in the northwest if BPA energy is to be sold.

WINS DISPLAY AWARD—For his victory garden window and interior displays during the 1944 season F. A. (Dusty) Rhoads, display supervisor for Electric Power Board of Chattanooga, center, recently received the "Plaque of Honor" from H. F. O'Neil, left, state manager for Calvert Distillers Corp. Looking on is Mayor Ed Bass of Chattanooga, who was active in the victory garden campaign

Darland to Replace Kent at Tacoma City Light

Resignation of Verne Kent, superintendent of the Tacoma, Wash., City Light Department since 1933, and appointment of Alvin Darland, supervisor of construction, maintenance and operation at Grand Coulee Dam, was announced last week by Tacoma's Utilities Commissioner C. A. Erdahl. Kent's resignation and Darland's appointment will become effective May 1.

Differences concerning the overall program to be followed in operation and development of City Light was the direct cause of the change, it was stated by Commissioner Erdahl who emphatically denied reports that Kent had been discharged.

In tendering his resignation, Kent stated his intentions were to resume his former position as foreman of wiremen with City Light. He has been with the department since 1917 and has been superintendent since January 2, 1933. He will be eligible for retirement in June, 1948.

Darland has been with the Bureau of Reclamation since construction was started on Grand Coulee, first as field engineer and later as supervisor of both the dam and the town of Coulee Dam. He is a native of Tacoma and was connected with City Light prior to joining the Reclamation Service. In his earlier career, he was an engineer with General Electric at Schenectady, N. Y.

In his new position, Darland will also become Tacoma's chief electrical engineer, a position which was combined with that of superintendent of City Light in order to boost his salary from $5,400 to $9,000 per year.

Program Will Up Power Consumption in Northwest

Electric Light & Power Association at Meeting of Utilization Section Learns That Sales of Major Appliances in 5-Years Post War Will Boost Average Power Sales 50 Percent or Close to 4,000 Kw.-Hr. Yearly

Utility business development programs in the five Pacific Northwest states and British Columbia in the first five years after the war will increase average residential power consumption about 50 percent or close to 4,000 kw.-hr. annually and raise average residential annual revenue to $50 or more.

This prediction is based on the report of the Electrical Development Committee of Northwest Electric Light & Power Association which was presented by the committee chairman, Pat Johnson, Puget Sound Power & Light Co., at the annual meeting of the Utilization Section of the association in Portland, Oregon, April 17 and 18.

Key sales people of the electric companies of the Northwest joined with manufacturer and jobber representatives at the meeting to prospect plans for the future. A. H. Wegner, Washington Water Power Co., was chairman of the meeting.

Back bone of the development program, Mr. Johnson indicated, will be the sale, chiefly by dealers, of 300,000 electric ranges, 200,000 water heaters, and 400,000 refrigerators. Contributing factors will be the sale of many other appliances such as automatic laundries, home freezing units, and kitchen devices.

Dealers Will Sell Most Appliances

That most appliance sales will be made by dealers was brought out in the portion of the program devoted to plans for cooperation with dealers which was in charge of J. H. Taylor, British Columbia Electric Railway Co.

Few utilities expect to do any merchandising, and these only to fill possible voids in territory coverage or to pioneer unaccepted appliances. Nor is any of the five-year objective expected to be a push-over since it was recognized there would be plenty of effective competition for the consumer's dollar. All the electric companies are planning to carry on aggressive promotional activities with home service demonstrations and advertising in several media.

At the same time manufacturers and distributors revealed that they will carry on selling and promotional campaigns to back up their dealers. This was brought out at a session given over to a "Parade of Manufacturers and Jobbers" in which representatives of these groups were given the opportunity to display proposed promotional plans and to prospect the timing and the extent of the availability of merchandise after victory. This part of the program was conducted by R. G. Chamberlain, Hurley Machine Co., Seattle.

Electric House Heating Discussed

An innovation at these meetings was a discussion of electric house heating in which A. C. McMicken, Portland General Electric Co., presented data on heating 20 small homes in Portland with thermostatically controlled individual room heaters. Most of the homes were four, five or six rooms, all of them weather stripped and insulated. Averages (in 1943) were cubic feet 7,971; connected load 15.9 kw.; kw.-hr. for heating 8,809; billing attributable to heating $75.74.

Mr. McMicken pointed out that if any considerable quantity of heating load is to be taken on, as is being suggested by the Bonneville Power Administration, the Bonneville rate of $17.50 per kilowatt-year will have to be adjusted so that the cost of power will be adequately covered in the revenue received from the customer. The need for more data on the characteristics of house heating load was seen; so a committee was appointed to gather and compile existing studies, and to determine what additional studies would be desirable.

In the report on water heating by R. E. Gale, Idaho Power Co., it was indicated that NEMA standards might be applied generally over the territory. A committee was authorized to find out if these standards could be adopted by all companies, having in view the probability that manufacturing costs could be reduced with a resulting lower price to water heater purchasers.

In considering the possibilities in rural electrification, R. S. Overstreet, Idaho Power Co., pointed to an average consumption by farm customers in one section of his territory amounting to 3,054 kw.-hr. per year, and stated that this did not represent the ultimate use of electric service on the farm that could be developed. This was borne out in a survey by T. K. Dimmitt, Puget Sound Power & Light Co., which showed a widespread interest among farmers in securing both home and farm electrical devices after the war, indicating an opportunity for more revenue from existing farm lines.

Utility leadership in promoting industrial growth in their territories was advocated by H. R. Kruse, Puget Sound Power & Light Co., as he told of industrial surveys his company was making in collaboration with chambers of commerce. This note was likewise sounded by T. E. Roach, vice-president and general manager, Northwestern Electric Co., in welcoming the delegates. He pointed out that the sale of surplus kilowatt hours expected after the war is not the sole end but only a means to the end which is employment of workers released from war industries.

Walter Potter, General Electric Co. Lamp Department, presented G. E.'s survey on fluorescent lighting which showed that better selling must be done if customers are to get the full benefit of fluorescent lighting and if lighting load were to be maintained in reasonable volume.

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Minnesota Legislative Act Restores Standard Time

After several weeks of inactivity, the problem of War Time raised its head again this week as the Minnesota legislature passed a bill restoring Standard Time effective July 1.

WPB Chairman J. A. Krug immediately sent a telegram to Gov. Edward Thye calling attention to the war agency's opposition to the retreat from War Time and asserting that nothing has happened since WPB representative Paul Valle testified against the move to make WPB change its position.

After Valle's testimony, as deputy director of the Office of War Utilities' Power Division, the Minnesota House killed a measure which would have put the state in the Mountain Time Zone, thus nullifying benefits of War Time. It was not known what caused the legislature to reverse itself suddenly as the session moved to a close.

A threat to War Time in Florida was averted when the Florida House declined to consider a bill reestablishing Standard Time in the state.

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New Jersey P.S.C. Changes

Congressman D. Lane Powers, Republican, has been appointed to the Public Service Commission of New Jersey by Gov. Walter E. Edge to succeed Crawford Jamieson.

Arkansas River Plan Hearings Scheduled

Army Engineers Plan Multiuse Project for Developing Valley at Proposed Cost of $522,687,000

Hearings will be conducted in Tulsa, Okla., on May 4 and 5, and in Little Rock, Ark., on May 7, by the Board of Engineers For Rivers and Harbors on a proposed $522,687,000 "comprehensive plan of improvement for the Arkansas River Valley" by the United States Engineers.

Power features of the multiple-purpose plan would make available 1,051,900,000 kw.-hr. of prime energy per year, of which 347,700,000 kw.-hr. would be generated by the existing and approved Pensacola, Markham Ferry, and Fort Gibson projects.

The hearings have been scheduled in the wake of mounting public approval for river development in the Arkansas watershed by the United States Army Engineers rather than by the so-called "Authority" method. The Arkansas legislature has urged Congress to make sufficient funds available to construct and operate all projects necessary to the planned program including "the benefits of navigation, irrigation and incidental power." City Councils in many cities in the Arkansas Valley likewise have gone on record as opposing the "Authority" method despite efforts of an Arkansas Valley Authority Association in Oklahoma to enlist support of municipal authorities.

Details of Proposed Plan

The comprehensive plan of development on which the hearings will be held was recommended to the Board of Engineers For Rivers and Harbors by a special board of officers known as the Arkansas Survey Board and the Southwest Division Engineer which termed it the Multiple-Purpose Plan. The plan provides for:

A 9-ft. channel for navigation from Cataoosa, Okla., on the Verdigris river down the Arkansas to Little Rock, a new canal from Little Rock to the White River and down the White to the Mississippi, 23 navigation locks and dams would be constructed to maintain the 9-ft. channel.

Thirteen reservoirs, (some containing power generating facilities) for flood control, sediment control, and power production, as well as aiding navigation.

Development of recreation and wild life potentialities in the valley.

The $522,687,000 cost estimated for the plan includes $76,560,000 required to complete the projects already approved, but does not include the cost of projects already completed. The total annual benefits are estimated at $26,366,200 of which only $912,800 is for flood control benefits. A total annual benefit of $19,606,000 from navigation, $5,586,500 from power sales, and $260,900 in land rental revenues is estimated to be possible under the plan. These benefits do not include any already estimated for approved reservoirs or for approved projects.

In addition to the $522,687,000 initial cost, an annual maintenance of $3,578,000 is estimated to be necessary for the plan.

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U.S.-Mexican Hydros Likely Under Treaty

Possibility of the development of substantial quantities of hydroelectric power on the Rio Grande River in plants owned jointly by the United States and Mexico—cost and output to be divided equally between the two countries—arose with consent by the Senate last week to ratification of the Mexican Water Treaty.

Under the treaty, three dams are to be erected across the Rio Grande and the International Boundary and Water Commission is instructed to study and report on the cost of developing water power at each. The dams, estimated to cost $86,000,000, of which the U. S. share would be about $53,000,000, would impound several million acre-feet of water and present definite power possibilities.

The treaty also requires construction by the U. S. of Davis Dam, located between Boulder and Parker Dams on the Colorado River. This project, to cost $41,000,000, has been authorized for construction with an ultimate generating capacity of 225,000 kw. in five units. Work on it was stopped early in the war by WPB.

Mexican approval of the treaty has not been formally completed, but it is not anticipated that it will be denied.

Power studies for the three international dams are expected to be carried out under the guidance of a joint technical staff of the U. S. and Mexican sections of the commission, but it is probable that experts from U. S. agencies dealing with power and private experts will be employed. One private engineering firm has been hired to carry out tests at a proposed international damsite, it was learned. None of the international damsites has been officially selected.

Headquarters for power study technicians will be the El Paso, Tex., office of the commission.

First Holding System Settles Adjustments

9 American Gas & Electric Firms Have Reached Agreement with FPC on Original Costs

American Gas & Electric Co. has become the first major holding company under Federal Power Commission jurisdiction to dispose of original cost adjustments as the result of FPC approval of proposals by the Appalachian Electric Power Co. to eliminate from its electric plant accounts a total of $36,870,306 remaining in its adjustment accounts.

As the result of field examinations by the commission's staff, the nine companies of American have disposed of amounts in excess of $75,000,000 without recourse to hearings or litigation. In a letter to George N. Tidd, president of the holding company, FPC Chairman Basil Manly said,

"It is gratifying to the Commission to recall that it was not necessary to institute formal proceedings with respect to any of the companies . . . in order to arrive at the amounts of the adjustments or to achieve appropriate dispositions thereof. The attitude of the company officials in cooperation with the Commission in achieving this laudable end is deeply appreciated."

Appalachian is the 113th company to dispose of original cost adjustments with FPC approval. Since 1940 a total of $820,178,948, representing write-ups and other adjustments in excess of original cost, has been ordered disposed from the plant accounts of the 113 utilities in conformance with the requirements of FPC's Uniform System of Accounts. All but ten of these adjustments have been voluntarily made as the result of company applications without formal hearings before the commission. Only the commission order to the California-Oregon Power Co. is now the subject of court review.

The other eight members of the American system are Atlantic City Electric Co., Indiana & Michigan Electric Co., Indiana General Service Co., Kentucky & West Virginia Power Co., Kingsport Utilities, Ohio Power Co., Scranton Electric Co., and Wheeling Electric Co.

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Nova Scotia Utility Sold

The purchase of the Barrington (N.S.) Electric Co. by the Western Nova Scotia Light & Power Co., Yarmouth, N.S., for $138,500 has been approved by the Nova Scotia Public Utilities Board.

30 Co-ops, 3 Utilities Sign New Contracts

Thirty rural electric cooperatives of of Texas, Arkansas, and Louisiana have signed a new wholesale power contract with three private utilities which will save the co-ops approximately $62,000 annually.

Under the contract, Southwestern Gas & Electric Co. reduced its rates from 8.2 to 5.6 mills per kw.-hr., a saving of $30,000; the Texas Power & Light Co. from 6.2 to 5.6 mills, a saving of $7,000; and the Gulf States Utilities Co. from 12.7 to 8.2 mills, a saving of $25,000. All of the contracts are retroactive, most of them to January 1, 1945.

The contracts offered by Southwestern and by Texas Power are effective until the end of the war plus six months. They may continue for 20 years, at the option of the co-op, or may be terminated by the co-op at any time on giving 12 months advance notice. A further stipulation is that the rates apply only for resale to loads up to 50 kw. demand, a somewhat higher rate applies to larger loads.

The agreement offered by Gulf States, while effective for only five years, places no restriction of kilowatt demand. Like the other contracts, the co-ops may terminate it with an advance notice of 12 months.

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Arkansas Utility to Erect 30,000-Kw. Generator Unit

Arkansas Power & Light Co. has applied to Arkansas Public Service Commission for Authority to construct a new 30,000-kw. generating plant near North Little Rock at a cost of approximately $3,000,000. The plant, designed by Ebasco Services, Inc., will be similar to the company's Harvey Couch power plant in south Arkansas. It will be of open air type construction.

Executive Vice-President C. S. Lynch, in announcing plans for the new plant, said the turbo-generator already has been purchased and bids have been received for other equipment. Application has been filed with WPB for priorities on the plant, which will tie into the company's system at nearby Dixie sub-station. Natural gas from south Arkansas fields will be used for fuel.

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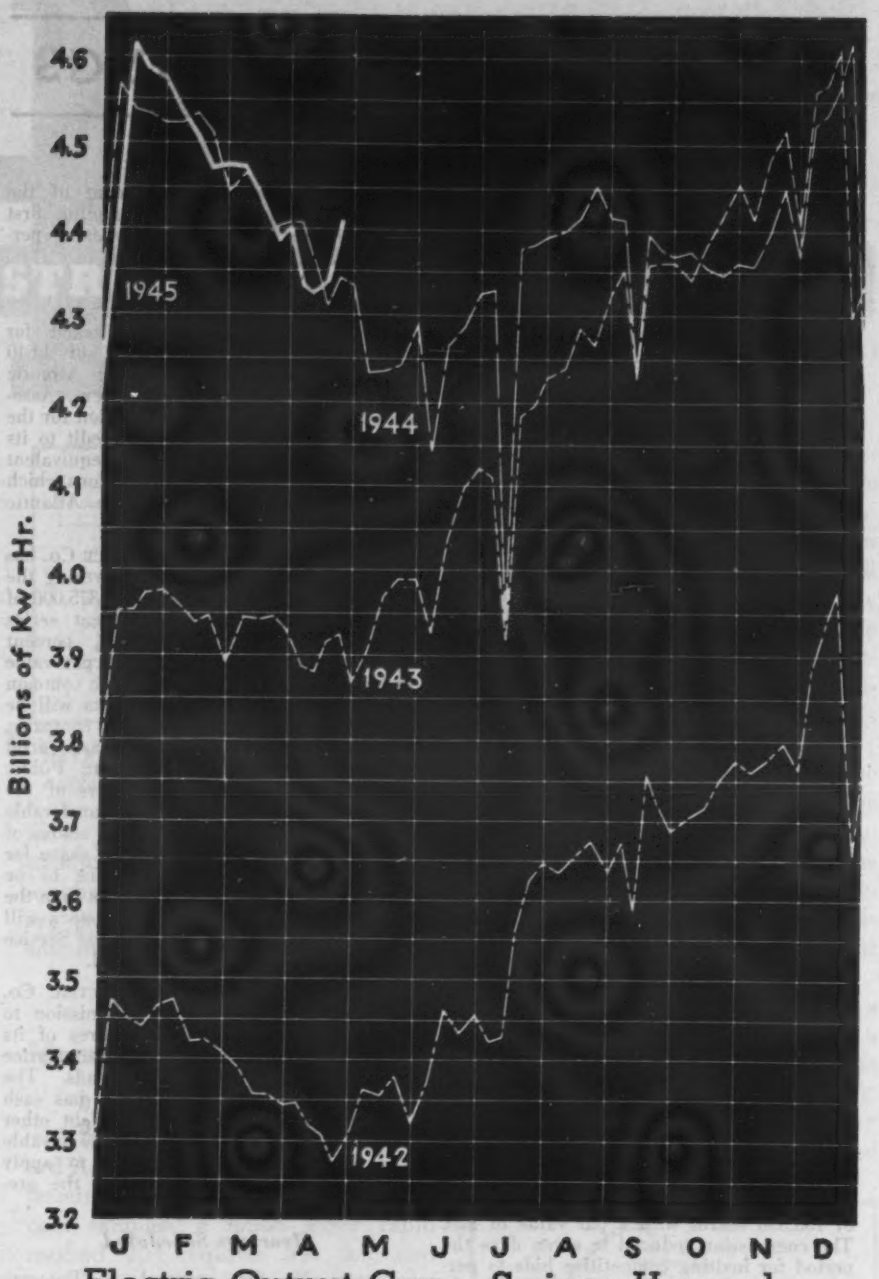
Municipal Plant Rejected

Voters of Chipley, Fla., served by the Gulf Power Co., have rejected a proposal for a municipally owned electric plant.



Electric Output Curve Swings Upward

The electric output curve moved upward during the week ended April 21, 1945, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power industry totaled 4,411,325,000 kw. hr., compared with 4,332,400,000 kw. hr. during the preceding week. During the week ended April 22, 1944, the amount of electrical energy distributed amounted to 4,344,188,000 kw. hr., this year's figure representing an increase of 1.5 percent.

Five of the major geographic regions reported gains for the week as compared with the corresponding week of 1944, the Rocky Mountain states moving into the plus column.

Again the West Central group of states showed the highest gain, reporting an increase of 8.7 percent.

Weekly Output Millions Kw.-Hr.

1945		1944		1943	
Apr. 21	4,411	Apr. 22	4,344	Apr. 24	3,925
Apr. 14	4,332	Apr. 15	4,307	Apr. 17	3,917
Apr. 7	4,322	Apr. 8	4,361	Apr. 10	3,882
Mar. 31	4,329	Apr. 1	4,409	Apr. 3	3,890
Mar. 24	4,402	Mar. 25	4,409	Mar. 27	3,928
Mar. 17	4,398	Mar. 18	4,400	Mar. 20	3,947
Mar. 10	4,446	Mar. 11	4,426	Mar. 13	3,945
Mar. 3	4,472	Mar. 4	4,465	Mar. 6	3,947
Feb. 24	4,474	Feb. 26	4,445	Feb. 27	3,893
Feb. 17	4,472	Feb. 19	4,512	Feb. 20	3,949
Feb. 10	4,505	Feb. 12	4,533	Feb. 13	3,940
Feb. 3	4,539	Feb. 5	4,524	Feb. 6	3,960

Percent Change from Previous Year

	Week Ending		
	Apr. 21	Apr. 14	Apr. 7
New England	+ 1.0	+ 0.0	+ 1.2
Mid Atlantic	— 3.0	— 3.4	— 5.2
Central Industrial	+ 1.7	+ 0.3	+ 0.8
West Central	+ 8.7	+10.6	+ 9.4
Southern States	+ 8.3	+ 7.7	+ 4.9
Rocky Mountain	+ 7.2	— 0.6	— 3.8
Pacific Coast	— 1.6	— 2.2	— 6.0
Total United States	+ 1.5	+ 0.6	— 0.9

SEC DECISIONS—HEARINGS

The Securities and Exchange Commission in a series of orders recently issued affecting electric utility companies:

ISSUED AN ORDER and opinion modifying the exemption granted the Long Island Lighting Co. in 1936 from the provisions of the utility Holding Company Act. The order places the Long Island Lighting Co. under the registration, security issuance and reorganization provisions of the act and gives the commission power to make any modifications in the company's capital structure that it deems necessary. The SEC modified the Long Island exemptions after the New York Circuit Court of Appeals upheld a lower court dicision refusing the SEC an injunction against the plan, which was approved by the New York Public Service Commission. In making reorganization and recapitalization subject to its approval the SEC acted upon a petition of holders of preferred stock who charged the plan was unfair to their interests.

HAS APPROVED a joint proposal filed by American Power & Light Co. and its subsidiary, Texas Electric Service Co., which provides for the reduction and refinancing of the outstanding mortgage debt of Texas Electric. Texas will issue and sell at competitive sale $18,000,000 first mortgage bonds to mature March 1, 1975, and will sell at private sale $2,500,000 promissory notes. The proceeds from sale of the bonds and notes are to be applied together with treasury cash, to redeem all of Texas' first mortgage bonds, 5 percent series, of which $33,730,000 are outstanding, at the redemption price of 103 plus accrued interest. Texas will use for this purpose $7,000,000 in cash which it will receive as a donation from its parent, American Power.

APPROVED SALE at competitive bidding by Northwest Utilities Co. of all the issued and outstanding common stock of its subsidiary, Lake Superior District Power Co., consisting of 133,550 shares with a par value of $20. The commission reduced to seven days the period for inviting competitive bids to permit the opening of bids on April 30. Northwest expects to apply the net proceeds from the sale to the purchase of additional shares of the common stock of its subsidiary, Wisconsin Power & Light Co., subject to future application to and approval by the SEC.

APPROVED SALE by Engineers Public Service Co. of its interest in Savannah (Ga.) Electric & Power Co. to Donner Estates, Inc., Philadelphia, and exempted Donner from provisions of the Holding Company Act.

HAS APPROVED Section 11 (E) plan of Republic Service Corp. for the sale of five of its subsidiaries for a total base consideration of $2,624,258. The company will sell its interest in Holston River Power Co. to American Gas & Electric Co., a subsidiary of Electric Bond & Share Co., for $688,189 and sell the Page Group properties to Potomac Edison Co., a subsidiary of American Water Works & Electric Co., for $1,936,069. The Page group includes the Page Power Co., Madison Power Co., Massanutten Power Corp. and Massanutten Water Corp. Republic will use the proceeds of the sale, with other funds, to make a pro rata payment of 60 percent of the principal amount of its outstanding first lien collateral trust 25-year bonds, 5 percent Series A, due 1951.

Applications Filed

MANILA ELECTRIC CO. has asked for approval of the transfer by it of 4,640 shares of the common stock of Atlantic Utility Service Corp. to its parent, Associated Electric Co. In consideration for the transfer, Associated agrees to credit to its open account with Manila a sum equivalent to all dividends or other distributions which Associated may receive on the Atlantic stock transferred to it.

SOUTHWESTERN ELECTRIC SERVICE CO. has filed a registration statement, covering the proposed issuance and sale of $2,375,000 of first mortgage bonds, 3⅜ percent series due 1975; 8,500 shares of 4¾ percent cumulative preferred stock, $100 par value and 128,935 shares of $1 par value common stock. Underwriting arrangements will be supplied by amendment. The company, newly organized to acquire the east-central Texas properties of Southwestern Public Service Co., will issue to holders of the common stock of that company transferable rights to subscribe to the 128,935 shares of new common at the rate of one share for each five shares held at a price to be supplied by amendment. Proceeds from the sale of the bonds and preferred stock will be used to pay Southwestern Public Service for the properties to be acquired.

GENERAL WATER, GAS & ELECTRIC CO. has filed a declaration for permission to retire the remaining 67,957 shares of its $3 preferred stock at the redemption price of $52.50 plus accrued dividends. The company told the commission it has cash balances of $6,872,000 and no debt other than current accruals and accounts payable and that the directors decided to apply $3,601,721 to the redemption of the preferred stock.

Hearings Scheduled

APRIL 30: On proposal of Potomac Edison Co. to offer the holders of its 29,182 shares of 7 percent and the 34,602 shares of 6 percent preferred stock, par $100, the privilege of exchanging their holdings on a share for share basis for a lower dividend rate preferred stock, also of $100 par value. The proposal would include a cash adjustment of accrued dividends in each case, with a further cash payment of $5 per share in connection with the 7 percent preferred exchanged. In the event the exchange plan becomes effective, the company proposes to use general funds to call all the unexchanged stock for redemption at the call price of $115 per share for the 7 percent and $110 per share for the 6 percent, plus accrued dividends.

MAY 1: On the application of Cities Service Co. and its subsidiaries for an additional year in which to effect compliance with the SEC order of May 5, 1944. This order directed Cities Service Co. to sever its relationships with all of the companies in which it has any interest, except Kansas City Gas Co., Wyandotte County Gas Co. and Gas Service Co., which the top holding company was allowed to retain as a single integrated gas untility system, and Cities Service Gas Co., which it was allowed to retain as reasonably incidental or economically necessary or appropriate to such system. The order was amended by the commission last October 12 to provide that instead of complying with the terms of the May 5 order, Cities Service Co. may dispose of its utility interests and retain all of its interests in companies engaged in the oil, wholesale natural gas and other non-utility businesses.

MAY 1: Oral argument on applications filed jointly by United Light & Power Co., United Light & Railways Co. and American Light & Traction Co., including proposals for the liquidation and dissolution of American and for the construction of a $70 million pipe line from the Hugoton gas field in Kansas to Detroit.

MAY 2: On joint applications filed by Massachusetts Utilities Associates, a subsidiary holding company of New England Power Association, and by Wachusett Electric Co., Leominster Electric Light & Power Co. and Middlesex County Electric Co., subsidiaries of Massachusetts. The applications cover steps incidental to the merger of Leominster and Middlesex into Wachusett.

MAY 2: On plan filed by Cities Service Power & Light Co. to transfer the ownership of St. Joseph (Mo.) Light & Power to Continental Gas & Electric Corp.

MAY 22: On plan of recapitalization and related and incidental transactions filed recently by New England Gas & Electric Association.

AUGUST 18: Hearing on plan filed by Consolidated Electric & Gas Co. to effect compliance with Section 11 (B) of the Holding Company Act, scheduled for April 18, has been postponed to August 18 at the request of the company.

UTILITY REPORTS

	Net Income 1945	1944
*California Electric Power and subs	$1,253,687	$1,265,917
†Central Maine Power	3,178,528	3,250,086
†Commonwealth & Southern and subs	11,849,536	12,011,719
†Connecticut Light & Power	3,948,560	3,661,890
†Detroit Edison and subs	5,163,968	9,036,790
†Idaho Power	1,380,553	1,314,890
*Iowa Public Service	658,610	673,522
†Public Service of New Hampshire	1,395,313	1,408,531

*Twelve months ended February 28.
†Twelve months ended March 31.

British 'Light Up' a Failure

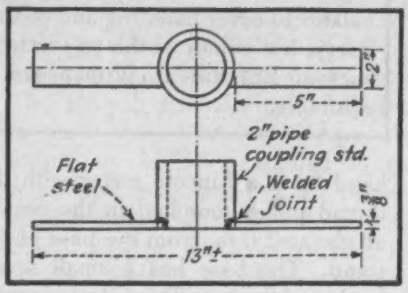
Blackout restrictions in Britain were lifted Monday night but not with the success that marked their establishment in August, 1939. Very few additional lights were shown because of the habits acquired during the blackout, the lack of wiring and fixtures destroyed during the bombing raids, and the shortage of power. Blackout restrictions still remain in force in a five-mile coastal strip.

HOW

DESIGN · CONSTRUCT · OPERATE · MAINTAIN

Safety Guide Aids Air Drill Work

Underground work on the Malden & Melrose (Mass.) Gas Light Co.'s system affiliated with New England Power, as on electric utility properties requires considerable drilling of brick and concrete pavement. To safeguard drill operators from accidents due to slipping of a bull point or air hammer when held between the feet, A. W. Clough, superintendent of distribution, designed the guide shown, the device consisting of a 2-in. standard pipe coupling 2 in. high, which is welded to a flat steel bar about 13 in. long, 2 in. wide, and ⅜ in. thick. The edges of the bar are filed for smoothness. The guide steadies the drill at all times, and weighs but 6¼ lb. The operator's feet are placed on the steel bar at each side of the coupling when drilling.



DETAIL of protective device for use in drilling pavement or flooring

PIPE COUPLING attached to steel base holds drill to course and protects operator's shoes and feet against slippage of tool while drilling pavement

Moisture in Coal Found by Distillation

Although oven-drying is the standard A.S.T.M.-approved method of determining the moisture content of coal samples, a much more rapid method that requires less skill and yet gives remarkably accurate results has been used at a certain well known steam-electric generating station in the middle west.

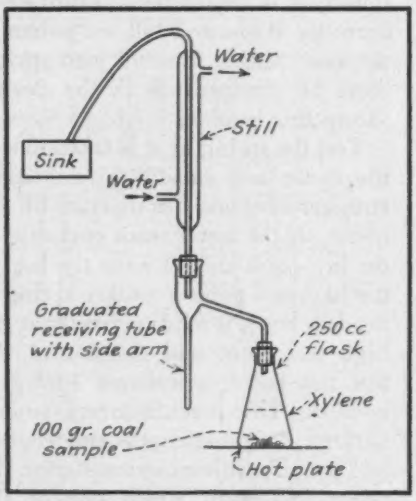
The method involves distillation of the coal sample with a liquid, such as xylene, that is immiscible with water. The distillate is received in a calibrated tube with side arm which returns the medium to the distilling flask while the water is trapped in the graduated tube. A sketch is shown of the apparatus, known widely in the chemical field as a Sterling moisture determination set.

Procedure followed in determining moisture content is as follows: The coal sample covered with moisture-free xylene in a 250-cc. wide-mouth flask is connected to the apparatus as shown and heated. The xylene and water vapor mixture, which distills off at a lower temperature than water alone, is condensed in the still and flows back into the receiving tube where the water separates from the lighter xylene and collects at the bottom of the graduated tube. Distillation is continued until water particles stop coming down from the still.

If a 100-gr. coal sample is used the moisture content of the sample can be determined directly from the graduated receiving tube. About two hours are required to make a moisture determination with this method. This contrasts with about 24 hours for the oven method.

The procedure outlined will give a slightly higher moisture content for a given coal sample than the oven method. The difference ranges from ½ to 2 percent.

A precaution should be observed



DISTILLATION of coal sample in xylene yields accurate determination of moisture content in two hours. Moisture from coal gathers in bottom of graduated receiving tube after condensation in still

in making a moisture determination with inflammable xylene as the medium. A tube should be run from the top of the still to the laboratory sink so that if the xylene boils too violently it will not overflow and catch fire.

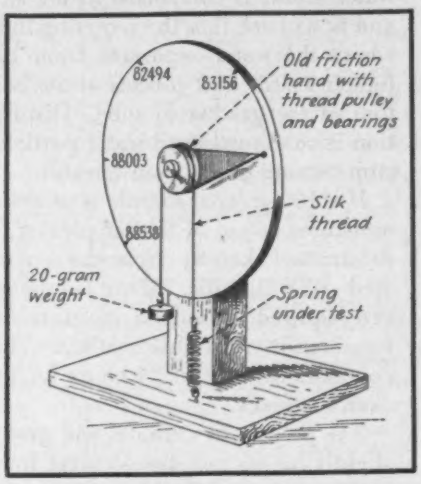
•

Spring Tester Devised for Thermal Meters

By J. P. DAWSON

Meter Engineer
Woodstock (Ont.) Public Utilities Commission

Lincoln demand meters are calibrated with a small spring as an adjustment on full load. As the meter becomes older the spring may change in characteristics, and this in turn changes the calibration of the meter.



WEIGHT REGISTERS on dial the stiffness of springs to adjust full load accuracy on thermal demand meters

If when the meter is tested "as found" it is impossible to calibrate it correctly at low and full test points at the same setting, the full load spring must be changed. With the device shown this is an easy job.

Test the spring as it is taken out of the meter and substitute one either stronger or weaker as dictated by the meter. If the meter reads correctly at the low point and 50 watts too low at the high test point a weaker spring is needed, but if it reads correctly at the high test point and too low at the low test point, a stronger spring is needed. The manufacturers supply springs in eight strengths and lengths, and by very little experimentation the tester will learn which one of the eight should be substituted on the first try.

The means of weighing the spring consists of a 4-in. dial with a driven hand from a Lincoln meter with the thread pulley mounted in the center, all elevated 6 in. from the base of the stand. The base has a small screw hook in it and a silk cord connects a small 20-gram weight to the small-hook. The spring to be weighed is hooked into it, then the cord passes over the pulley on the hand and the weight hangs free on the other side. Lift the weight up with the finger until the spring under test is not under tension. Set the pointer at zero and release the weight. A complete set of new springs from the factory was bought to be used as improvised standards, and the catalogue numbers put on the dial where the pointer stopped when weight was released.

•

Circular Calculators Made Available

Calculators on eight subjects, itemized in the following list, are made available to readers of this publication by the generosity of V. W. Palen, the author and designer of the calculators. Printed on cardboard, the sections can be readily trimmed and assembled for use.

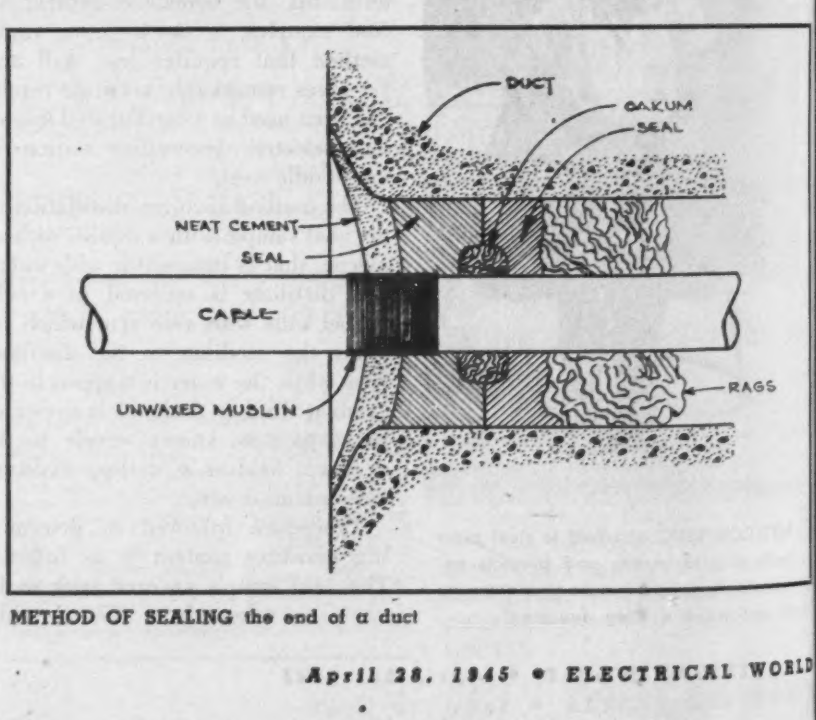
One or more calculators may be obtained, as long as the supply lasts, by addressing your request to Editor, ELECTRICAL WORLD, 330 West 42nd St., New York 18, N. Y., and inclosing 10 cents in stamps for each calculator to cover handling and postage. Sorry, but copies of the respective issues of ELECTRICAL WORLD are not available.

Calculator Items and Date of Publication
Transformer Capacity Calculator March 11, 1939, page 94.
Decayed Pole Strength Calculator May 18, 1940, page 84.
KVA.-KW.-HP. Calculator May 17, 1941, page 88.
WRC Pole Class Calculator September 20, 1941, page 102.
Line Current Calculator February 7, 1942, page 86.
I^2R Line Loss Calculator March 7, 1942, page 90.
Corner Guying Calculator August 22, 1942, page 80.
Line Clearance Calculator October 3, 1942, page 84.

Mason's Trick Used in Underground Duct

An old mason's trick of tapping off enough water to relieve the pressure when sealing up an opening has been successfully applied by the Philadelphia Electric Co. to cable ducts that pick up water. Insertion of a short length of garden hose through which the water is allowed to run while sealing the end of the duct prevents accumulation of pressure that would otherwise push the seal out.

The seal made of rags, sealing compound, oakum and neat cement is packed around the hose which is left open until the seal has set; then the hose is plugged. When the duct is to be used, the seal is broken out and the



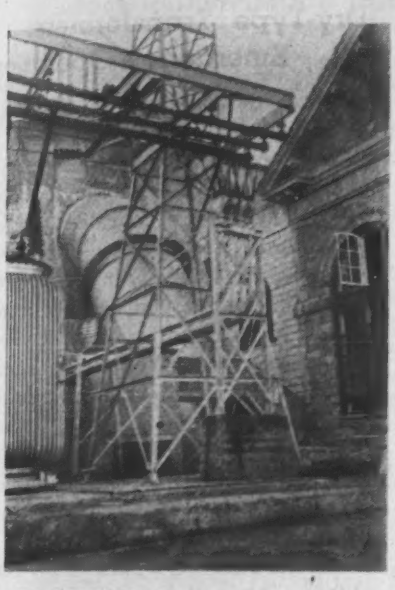
METHOD OF SEALING the end of a duct

cable installed. A short length of hose is laid on top of and parallel to the cable, and the seal remade as previously described. When set up, the hose is withdrawn and opening plugged with duct seal and neat cement.

•

Floodproofing Outgoing Cable Lines

Between the dam and station building of an eastern hydroelectric plant sufficient space was found to locate step-up transformers tying the plant into the transmission system of the



TIE CIRCUITS between transformers and station are supported on steel framing above tailrace level

company, utilizing a concrete mat in front of the dam. To maintain the connections between the generators within the station and the transformer bank well above the tailrace level, the cables from the generators were brought out in metal conduit and carried upward near the front of the mat to an outdoor bus above the transformers as shown. A steel tower support was provided for the bus structure and insulators, and members added on a concrete pier to carry the cables upward to pothead outlets from which short taps were run to the buses. The layout insured safe access to the transformer platform and a clearance of at least 15 ft. from the probable maximum stage of the river. The top of the steel tower at the end of the mat in front of the penstock shown was also available for outgoing line terminal service.

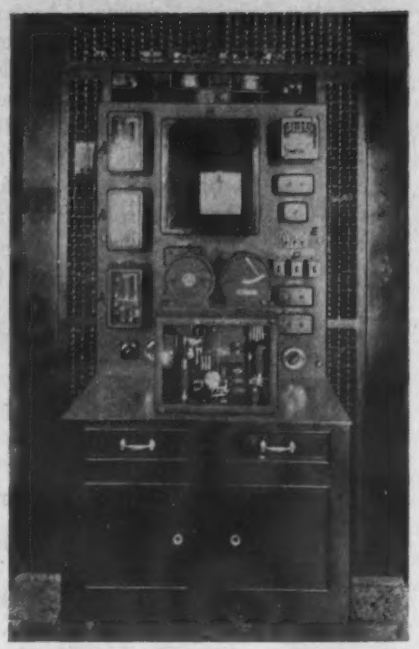
Faults of Three Systems on a Single Oscillograph

By GEORGE STEEB
Relay Engineer
Buffalo Niagara Electric Corp.

Means for switching a single six-element automatic oscillograph has made it possible to record as many as 12 quantities associated with faults occurring on the sections of either the 25 or 60-cycle systems out of C. R. Huntley Generating Station.

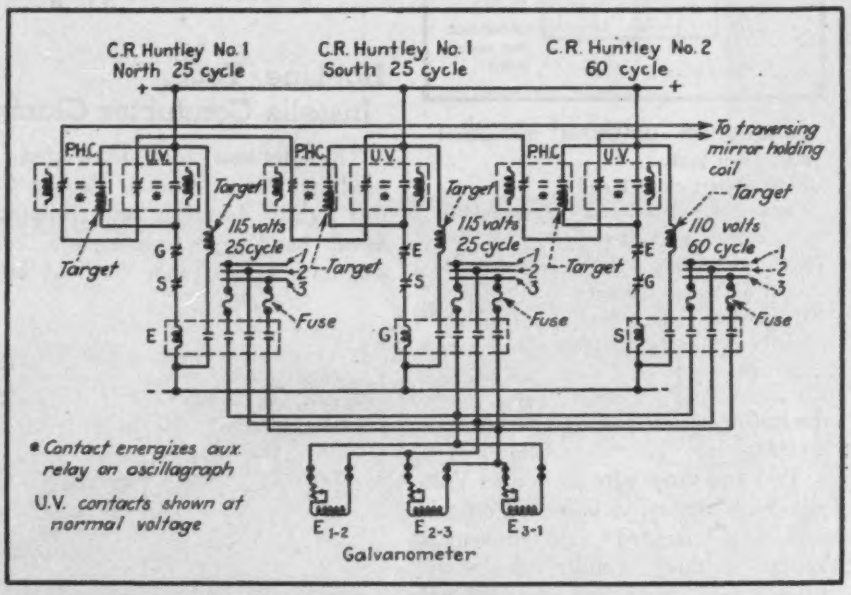
Three bus sections are involved, the 25-cycle North and South synchronizing buses of C. R. Huntley No. 1 and the 60-cycle bus at Huntley No. 2. The corresponding under-voltage relays are the top, middle, and bottom ones marked A in the photograph. The 115-volt secondaries are applied to three copper-oxide rectifiers, the output of which is applied to the relay operating coils; a 10 percent drop in voltage will close the contacts. The G.E. type PHC overcurrent relay (marked C) has three operating coils each operating a separate set of contacts on actuation by ground current in one of the station neutrals.

Selective action is achieved by use of three transfer relays (Auto Electric Sales Co. Type AQA, 3 amp.) marked D. The right hand one is for 60-cycle operation and is timed to operate in ¼ cycle: the others are for 25-cycle and operate in ½ and ¾ cycles respectively. This time differential gives preferential action in case of simultaneous faults or inductive transfers from closely parallel circuits.



RELAY PANEL for switching automatic oscillograph to the faulted system. Lower cabinets contain (left) battery and charger, (right) shunts for oscillograph galvanometer elements

Thus either a ground current in any of the three systems will operate the corresponding overcurrent (PHC) relay or a drop in voltage will operate the undervoltage relays. In either case



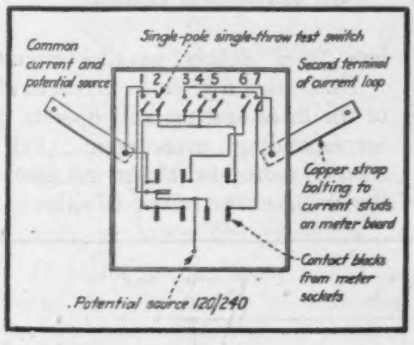
SCHEMATIC DIAGRAM OF TRANSFER RELAYS:
PHC = overcurrent relay with 3 coils, each has one break and two make contacts
UV = undervoltage relays with one break and two make contacts
E, G, S = telephone-type transfer relays each with two break and four make contacts

the traversing mirror holding coil of the automatic oscillograph will be de-energized and the oscillograph started with not over ½ cycle delay (60-cycle basis) to record on each element the quantity chosen. A cam contact on the oscillograph operates a bell alarm and also energizes the solenoid of the graphic timer B (see ELECTRICAL WORLD, April 28, 1934, page 627) which records the time of the operation within one second of its occurrence. The overcurrent and transfer relays have targets. If two targets appear the operator knows that a ground fault has occurred; if only one target appears it is a phase-to-phase or three-phase fault.

•

Detachable Test Jack for Socket Meters

The accompanying photograph and connection diagram show details of a detachable "socket meter test jack" used at the meter department of Nebraska Power Co., Omaha. The jack which can be bolted to the face of the meter test board in less than a minute when it is desirable to switch from


Common current and potential source
Single-pole single-throw test switch
1 2 3 4 5 6 7
Second terminal of current loop
Copper strap bolting to current studs on meter board
Contact blocks from meter sockets
Potential source 120/240

CONNECTION DIAGRAM for socket meter test jack.
2-wire meter; close 2 and 5
3-wire meter; close 3 and 4, potential tap to clip on back of meter
V-25 meter; close 1 load 5 or 7 depending on meter element
V-63 meter; close 1, load 6 or 7, potential tap to screw in middle clip on back of meter

the testing of "A" base to socket type meters.

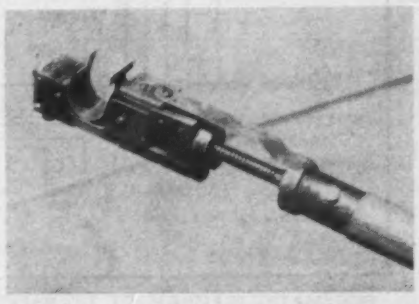
Two and three-wire as well as V-28 and V-68 meters, to be tested on this jack, are "plugged" into clips of a group of three contact blocks arranged as shown. An additional (eighth) contact clip has been inset in the bottom of the center block to provide the range of connections required for the meters to be tested. These contact blocks together with the necessary SPST test switches are mounted on a wood panel, approximately a foot square, which can be bolted by means of heavy copper straps, which form its current and one potential lead, to studs that are the terminals of the current supply loop on the main test panel. The other necessary 120/240-volt potential supply connection is made with a flexible lead to a stud at the center bottom of the jack. Certain types of watthour meters require a potential connection by means of a second flexible lead to this same stud.

DETACHABLE test jack being installed on meter test board preparatory to testing socket meters

•

Hot-Line Tool Installs Conductor Clamps

The hot-line tool illustrated is used by Pacific Gas & Electric Co. for tightly forming and crimping metal bands on transmission connectors to hold strands that may have been broken by vibration from becoming loose and dangling. The illustration shows a metal band in the jaws of the tool ready for being placed on the wire. Screwing the handle forms the band tightly around the wire and a metal slide on the top side clinches the prongs of the clamp to form a very tight fitting connection. Jaws of the correct curvature are used for a particular conductor. The tool was first made by the Safety Live Line Tool Co., of Oakland, Calif., at the request of Pacific Gas & Electric engineers.



BROKEN TRANSMISSION conductor strands are clamped rigidly by specially designed hot-line tool

•

Dry-Type Transformers: Emergency Operation

Instances have been noted where dry-type transformers with Class B insulation operated under emergency conditions at overloads ranging from 150 to 200 percent of rated load for continuous periods of time in excess of 24 hours. The windings must have been subjected to temperatures appreciably in excess of 160 deg. C. This was related by W. W. Satterlee, Transformer Engineer of Westinghouse Electric & Manufacturing Co., Sharon, Pa., in a paper presented at a recent meeting of International Association of Electrical Inspectors in Albany, N. Y.

In one instance, a bank of 150-kva., 4,000-volt transformers carried in excess of 150 percent of rated load for a period of nearly three days. This overload occurred nearly four years ago. A careful inspection of these transformers did not indicate any noticeable deterioration of the insulation. These transformers have continued to give uninterrupted service.

Two years ago, another bank of dry-type transformers carried approximately double load for more than 24 hours. These transformers have continued to operate without any ill effects of this heavy overload.

A 600-kva., 13,800-volt, three-phase, dry-type transformer, after having been in service over one year, was operated at 200 percent of rated load for a period of 30 hours. It is estimated that the maximum temperature of the windings was in excess of 225 deg. C. No failure occurred and the transformer has continued in service for another year without indication of deterioration of the insulation.

HERMETICALLY SEALED

against humidity and fungus

—another G-E "FIRST" in electric-instrument design

● The Pacific war area is probably the toughest instrument-proving ground in the world. To meet the requirements of such severe service, G-E engineers have designed a 2½-inch panel instrument that *IS hermetically sealed.* No detail has been overlooked to make this critical radio component impervious to the tropical conditions of high humidity, extreme temperature, and fungus growth.

Sealed Throughout. Vacuum-tight sealing assures a hermetic enclosure: Thick, strain-free glass is fused to a metal ring by a glass-to-metal seal; then, this assembly is sealed to a steel case. The two terminals are sealed, glass-to-metal; then, this assembly is sealed to a steel base. Lastly, the steel base is sealed to the steel case by a synthetic-rubber gasket, which is treated with a special sealing compound and compressed and secured by a crimped-over metal ring.

Filled with Inert Gas. The final assembly is evacuated, filled with an inert gas through a tube in the base, and is sealed off at a pressure slightly above atmospheric.

Internal-pivot Design. The combination of this hermetic enclosure and the combat-proved G-E internal-pivot element makes an outstanding instrument. It is not only sealed against jungle humidity and fungus, but it is also well able to withstand thermal shock, mechanical shock, and fatigue vibration and still maintain its rated accuracy.

For advance information, ask the nearest G-E office for Booklet GEA-4429, or write to General Electric Co., Schenectady 5, N.Y.

Type DW-61 d-c voltmeters, ammeters, milliammeters, and microammeters

Type DW-62 radio-frequency ammeters and milliammeters

AN INTERNAL-PIVOT DESIGN

External Pivot **Internal Pivot**

For thinness—pivots are mounted on the *inside* of the armature

For sturdiness—parts that require a definite location in relation to each other are securely fastened together to assure permanent alignment

High factor of merit—resulting from a featherweight moving element and high torque

Plus Hermetic Sealing—Another G-E First

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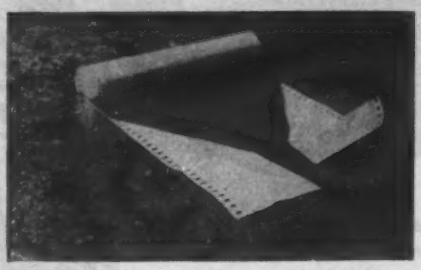
Fits Demand Charts with Tin Template

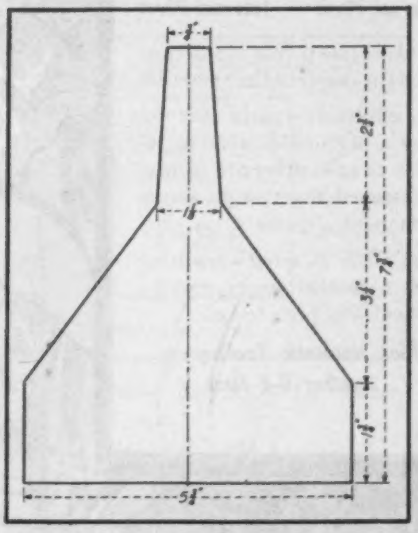
By C. W. PINKEL
Meter Supervisor, Illinois Power Co., Belleville, Ill.

In changing demand charts on Westinghouse Type R-A and R-2 meters (and other meters taking strip charts) it was found that if the chart was cut to fit the slots in the reroll



TEMPLATE held by one hand while the other tears the paper to form the end tab for application to reroll spool of meter

spool, the chart would roll up smoothly. However, it was not found practical to cut the charts with a knife and scissors in the field especially during bad weather.



THIN METAL cut to these dimensions serves to trim ends of demand charts for smoother feeding

In order to overcome this difficulty and to cut all demand charts the same a template or guide was cut out, to use in cutting charts to proper size. This guide was made from a thin piece of tin. The guide measures 5¼ in. across the top and ¾ in. across the tapered or small end. The accompanying diagram shows other dimensions.

By inserting the tapered part of the chart into the spool the chart will wind up smoothly and straighter than if the chart is cut uneven. By using this guide a large number of charts can be cut in a short time. This will make it unnecessary to try to cut the charts in the field during bad weather.

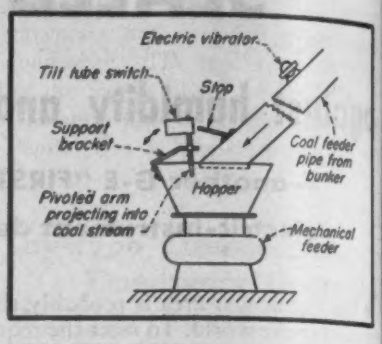
• • •

Frees Coal Stoppage in Feeder Pipe

Mercury tilt tube switches mounted on pivoted, counter-balanced arms projecting into the coal stream emerging from feeder pipes supplying cool pulverizers at the Ohio River Station of Southern Indiana Gas & Electric Co., Evansville, automatically start Syntron-type electric vibrators on the pipe to restore coal flow stopped by arching or clogging of moist coal in the feeder.

Arrangement of the tilt tube is shown in the accompanying sketch. When coal stops flowing from the feeder the lower end of the arm carrying the tilt tube is freed, allowing the arm to drop of its own weight and close the circuit to the vibrator through the tilt tube.

While the vibrators free all but the most serious obstructions in the feeder pipes, they have no effect on coal that has arched in the bunkers. To meet this threat to continuous

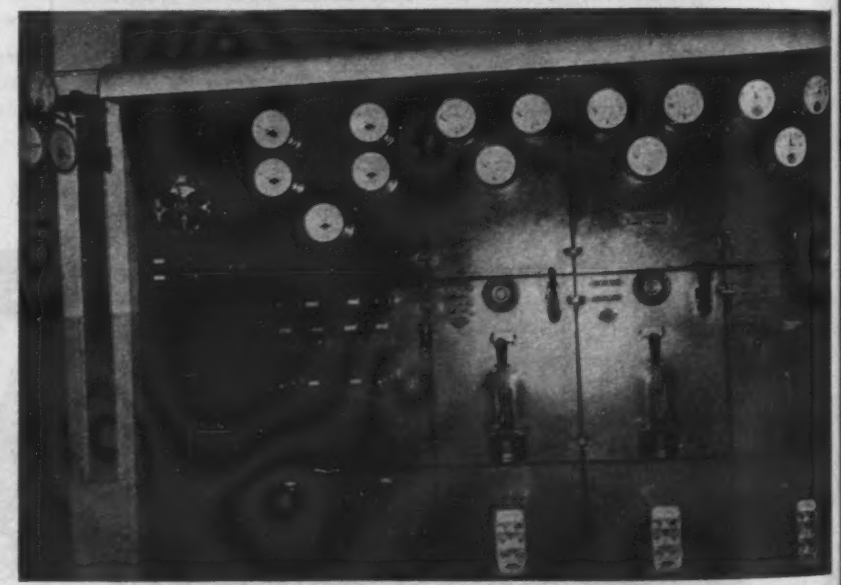


TILT-TUBE SWITCH on counter balanced-arm, projecting into coal stream from feeder pipe, starts vibrator automatically when coal flow stops

coal supply to the mills, a number of compressed air jets have been installed at four levels in the bunkers. These jets inject compressed air at 100 psi. directly into the bunker and in most cases will break down the arch. Valves controlling the jets are operated from the boiler room.

• • •

Auxiliary Lighting Helps Station Operators

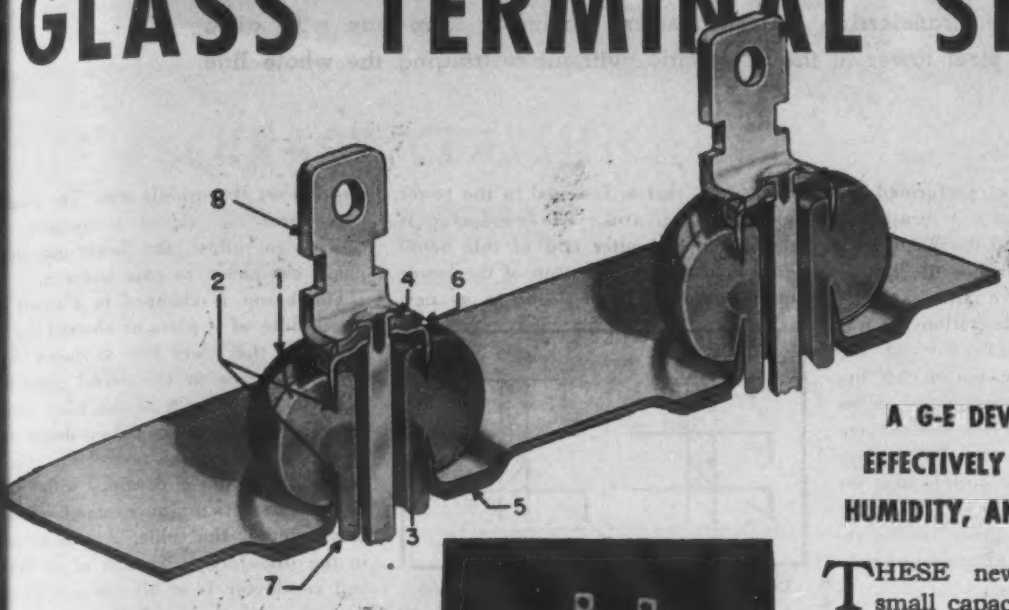


"FOOTLIGHT-LIKE" TROUGH mounted at the top of the operating board at the Tarentum (Pa.) municipal light plant provides added illumination to facilitate meter reading. Trough is made of 12-gauge galvanized steel bent into a 10-in. semicircle and contains thirteen 25-watt bulbs spaced 24 in. apart. The inside surface is painted white for better reflection; the outside, white with a 2-in. black stripe for appearance. This is attached to the board by stove bolts set in anchor lugs

Announcing

a distinct advance in small-capacitor design

GLASS TERMINAL SEALS



A G-E DEVELOPMENT THAT EFFECTIVELY RESISTS FUNGUS, HUMIDITY, AND THERMAL SHOCK

THESE new terminal seals for small capacitors are based on the many glass-to-metal seal developments pioneered by our Research Laboratory and Lamp Department over a period of years. The seal is similar, in many respects, to the seals being used so successfully to maintain a high vacuum indefinitely in G-E sealed-beam headlamps, millions of which are now in use.

This development makes possible a capacitor seal that will withstand the most severe operating conditions—sudden or prolonged heat or cold, high altitude, rain, humidity, fungus, and microscopic animal infiltration. It differs from most glass-to-metal seals in that it does not *rely* on soft solder for mechanical strength, nor on matched coefficients of expansion of glass and metal to resist thermal shock.

G-E Pyranol capacitor (case style CP-62) equipped with glass terminal seals

G-E capacitors equipped with glass terminal seals are, at present, available in case styles CP-60, -62, and -64 in all ratings covered by proposed specification JAN-C-25, for use in combat communications equipment where severe operating conditions may be encountered. Ask for Bulletin GEA-4424 for complete information. *General Electric Company, Schenectady 5, N. Y.*

- Exceptionally stable, low-expansion glass, practically unaffected by weathering, microorganisms, and thermal shock.
- Metal sections, made of corrosion-resistant nickel-steel, are sealed into opposite ends of the glass by a heating process in which the oxide on the steel is fused into the glass to form an impervious bond between the two.
- Metal sections are tapered to keep stresses in the glass at negligible values under thermal-shock conditions. The seal is designed to pass American War Standard thermocycle tests with a wide margin of safety.
- High mechanical strength is provided because terminal is *riveted* to top metal section, and,
- Terminal seal is brazed to capacitor cover.
- All joints are hermetically sealed. None *relies* on soft solder for mechanical strength.
- Adequate electrical clearance between lead and case is maintained by the glass skirt.
- Easy attachment of external leads is assured by making terminal of *solder-dipped* brass.

Buy all the BONDS you can—and keep all you buy

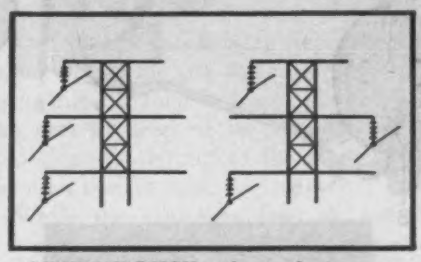
GENERAL ELECTRIC

HOW TO TRANSFER A CONDUCTOR OVER TOP OF A TOWER

Method involves the use of a boom controlled by chain-type hoists in transferring a transmission conductor from one side of a steel tower to the other side, without restringing the whole line

Conductor transfer was performed recently at every tower of a transmission line between Chicago and the Waukegan, Illinois, generating station of the Public Service Co. of Northern Illinois. The method used (see illustrations), was developed by E. Morgan Fee of the company's Northern Division electric operating department and submitted as an employee suggestion. Fee's method enables a six-man gang to transfer the top (East) conductor to the middle arm on the opposite side of the tower and move the middle (East) conductor to the vacated top arm position in approximately 1½ hours per structure.

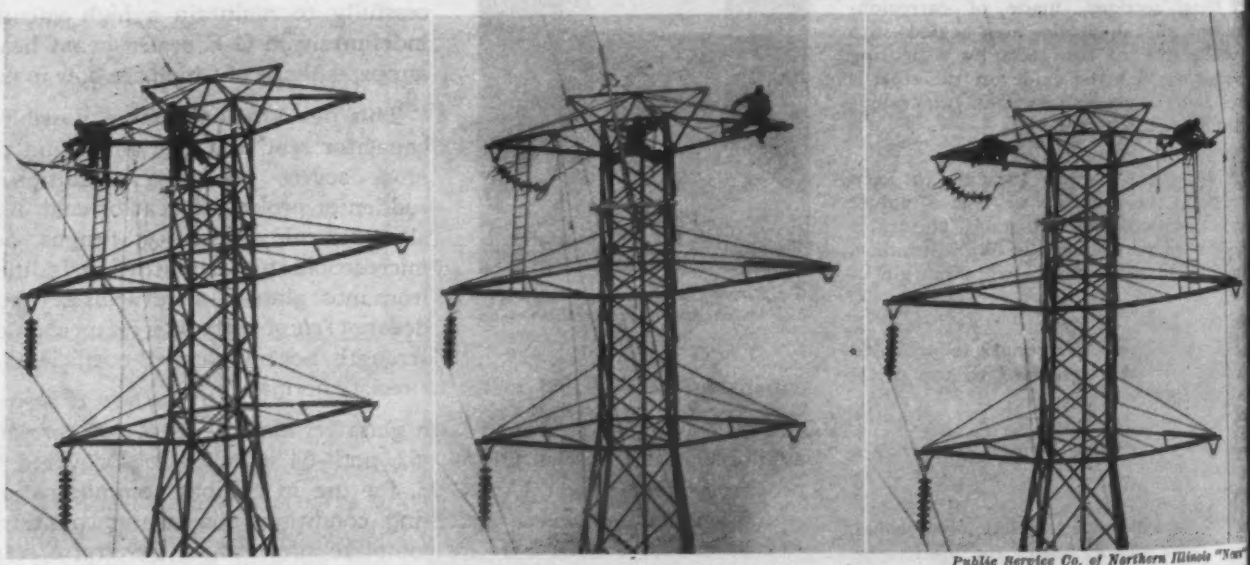
Key to Fee's method is a boom, pivoted at one end, that is fastened to the tower below the top arm. The conductor is attached to the outer end of this boom and swung up, over the top of the tower and down on the other side to its new position on the middle arm. The ground wire must be raised temporarily, of course, to allow the boom-supported phase conductor to pass under it.



CONFIGURATION of conductors on tower: (left) original, (right) final

The boom is clamped to a swivel in the middle of a plate or channel that is bolted to the tower legs as shown. Provision is made at the swivel clamp for adjusting the length of the boom under load so that the boom and conductor will clear the end of the tower arms. Outer end of the boom is provided with a conductor clamp that allows some lengthwise movement of the cable. As can be seen in the illustrations, motion of the boom and conductor is at all times under the control of chain-type hoists.

Steps in Transfer of A Conductor



Public Service Co. of Northern Illinois "Nan"

TOWERMEN USE swivel boom to shift transmission conductor from one side of a tower to the other. (Left) Boom has been attached to conductor and strain taken so insulator string can be detached. (Center) Conductor and boom are moving over top of tower. Ground wire had been lifted to permit boom to pass under it. (Right) Conductor is being lowered on opposite side of tower to its new location on the center arm. Final operation: conductor on middle arm will be raised to top arm

BUYING AN INSTRUMENT TRANSFORMER LIKE THIS...?

ITS ACCURACY CLASSIFICATION IS IMPORTANT!

ASA Burden	B-0.1	B-0.2	B-0.5	B-2
ASA Accuracy Class	0.3	0.3	0.3	0.3

This means that, with standard ASA burdens, the ratio correction factor and the transformer correction factor will be within the limits of the ASA accuracy class 0.3.

NEMA Burden	X	Y	Z
NEMA Accuracy Class	¼	¼	¼

This means that, with standard NEMA burdens, the ratio error and the phase-angle will be within the limits of the NEMA ¼ accuracy class.

Type KF-316 current transformer, 34,500 volts, for accurate metering service and relay operation

FOR A BETTER UNDERSTANDING OF ACCURACY CLASSIFICATION

This publication explains the ASA accuracy standards for current and potential transformers and shows how they differ from the NEMA standards. Also, you will find this booklet a handy guide to the selection of G-E instrument transformers. Ask for your copy of GEA-4240 today. Address the G-E office nearest you.

ALL G-E instrument transformers are classified in accordance with the new ASA system, but to get the *right transformer* for your particular need, an understanding of this new system is very helpful.

For example, different applications often require different transformer characteristics. A transformer that is satisfactory for metering purposes (highest accuracy up to 100 per cent of its current rating) may not be satisfactory for relaying purposes where the *overcurrent* characteristics (currents as much as 20 times normal) must be considered.

The ASA system of accuracy classification has made possible the most precise method yet devised for selecting instrument transformers. A thorough knowledge of this system will help you in the selection of transformers with the most suitable characteristics for the job to be done. *General Electric Company, Schenectady 5, N. Y.*

HEADQUARTERS FOR ELECTRICAL MEASUREMENT

Buy all the BONDS you can—*and keep all you buy*

GENERAL ELECTRIC

804-15-8400

Repetitive-Manufacture

An appraisal of their adaptability from

When you consider transformer taps, tolerances, and ratios, and allow for system variables, you can take advantage of RM listings for many step-down applications and reduce your investment costs.

THE fact that more and more orders are specifying repetitively manufactured power transformers in place of "specials" is proof that many companies are finding these transformers a fertile field for reducing their capital investment.

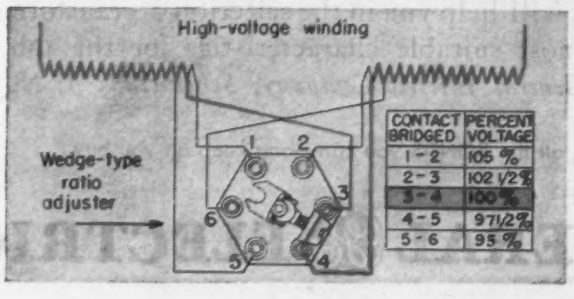
Many engineers, however, while recognizing the cost-reducing possibilities of RM-listed power transformers, have hesitated to take advantage of them because of real or fancied difficulties in the application of these units.

For example, RM-listed *voltage ratings* are sometimes considered a stumbling block by those who believe they need "special" voltages. But even here, as with RM-listed kva ratings, there is a flexibility which, when properly utilized, will often satisfy "special" conditions.

Consideration of the following factors will help you take advantage of RM-listed voltage ratings and enjoy the savings they make possible.

STANDARD TAPS ADD TO THE NUMBER OF VOLTAGES YOU GET

After detailed study of industry requirements, RM-listed voltage ratings were selected as those which would best meet the majority of applications. There are 325 combinations of high- and low-voltage ratings available between 66,000 and 480 volts—250 combinations for three-phase transformers and 75 for single-phase transformers. However, if no RM-listed unit has a *nameplate* rating of the voltage you want, you may find that the standard taps will approximate this voltage. Two 2½ per-cent taps above, and two 2½ per-cent taps below, rated high voltage make RM-listed units suitable for use at rated kva at different points on a system, or where the supply voltage differs from nominal.



CONTACT BRIDGED	PERCENT VOLTAGE
1-2	105 %
2-3	102½%
3-4	100 %
4-5	97½%
5-6	95 %

DIFFERENT L-V RATINGS HELP PROVIDE FOR VOLTAGE DROP

The following wide range of RM-listed low-voltage ratings permits a selection best suited to compensate for voltage drop in secondary feeders of various lengths and capacities:

Single-phase	Three-phase	
480 △	208Y/120	4330Y
600 △	240 △	5000 △
2400/4160Y	480Y/277	7200 △
2500/4330Y	480 △	8660Y
5000/8660Y	600 △	12000 △ or Y
7200/12470Y	2400 △	12470 △ or Y
12470 △	2500 △	13800 △ or Y
13800 △	4160Y	14400 △ or Y
14400 △		

PERMISSIBLE TOLERANCES MAY NULLIFY "EXACT" VOLTAGES OF "SPECIALS"

Although transformer voltage ratings can be realized with a high degree of accuracy, ASA Standards provide a tolerance whereby, with rated voltage impressed on one winding, the other transformer voltages at no load may differ from the nameplate marking by ±½ of 1 per cent. Hence, there may be doubtful value to the purchaser who specifies some "exact," intermediate special voltage.

Power Transformers

*the standpoint of VOLTAGE RATING**

VOLTAGE RATIOS AS IMPORTANT AS NAMEPLATE RATINGS

It is often possible to take advantage of an RM-listed transformer if the ratio between the high- and low-voltage ratings is the same as the ratio between the *actual* primary voltage and the desired no-load voltage at the low-voltage terminals.

Example A

Available primary voltage.....2400
Desired no-load secondary voltage.....460
Use RM-listed rating of.....2400 to 480
connected for tap voltage of.....2520 to 480
and apply primary voltage of.....2400 and get 457

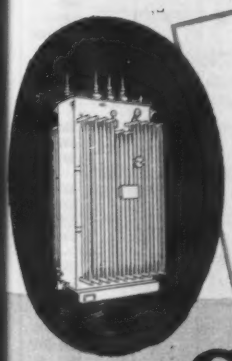
Considering the permissible ASA tolerance of ±½ of 1 per cent, the voltage may be anywhere from 455 to 459 volts.

Example B

Wanted, a transformer rated 13,800 to 2500 volts, with four 2½ per-cent taps below rated high voltage.

Use an RM-listed rating of 13,200 to 2500 volts, with two 2½ per-cent taps above and two 2½ per-cent taps below rated high voltage:

Apply voltage of	to tap connection of	and get voltage of
13,800	13,860	2489
or 13,455	13,530	2486
or 13,110	13,200	2483
or 12,765	12,870	2480
or 12,420	12,540	2476
		All within 1 per cent of 2500



RM-listed power transformers and unit substations are the result of repetitive manufacture of standard designs. Many of the parts used are manufactured in large quantities and carried in stock. The benefits to you: Quicker shipment (about 33 per cent less time), lower cost (6 per cent less), and simplified purchasing.

Even in the most unfavorable case, i.e., 2476 minus 0.5 per-cent tolerance, the no-load voltage is 2464, which is within 1½ per cent of 2500.

In the foregoing examples, note that ASA Standards provide that a transformer shall be capable of: (1) delivering rated output kva at 5 per cent above rated output voltage and (2) operating at 10 per cent above rated output voltage at no load, without exceeding the guaranteed temperature rise. This applies to the rated voltage and rated kva for any tap.

The following tabulation will prove useful in determining how other than rated nameplate voltages can be obtained on any RM-listed transformer.

Per Cent of Rated High Voltage Applied	High-voltage Winding Tap Connection	Per Cent of Rated Low Voltage Obtained at No Load
105	105	100
	102.5	102.4
	100	105
	97.5	Not Practical
	95	
102.5	105	97.6 (Reduced Kva)†
	102.5	100
	100	102.5
	97.5	105.1
	95	Not Practical
100	105	95.2 (Reduced Kva)†
	102.5	97.5 (Reduced Kva)†
	100	100
	97.5	102.6
	95	105.2
97.5	105	92.8 (Reduced Kva)†
	102.5	95.1 (Reduced Kva)†
	100	97.5 (Reduced Kva)†
	97.5	100
	95	102.6
95	105	90.5 (Reduced Kva)†
	102.5	92.7 (Reduced Kva)†
	100	95 (Reduced Kva)†
	97.5	97.5 (Reduced Kva)†
	95	100

†The percentage of rated kva obtainable is the same as the per cent of rated low voltage

*This is the second in a series of messages designed to help you select and apply RM-listed G-E power transformers—to help you gain the maximum benefit from them. Ask for Booklet GEA-4283 for complete descriptive information, and Booklet GEA-4338 for additional data on how to select and apply these transformers. *General Electric Company, Schenectady 5, N. Y.*

Buy all the BONDS you can—and *keep all you buy*

GENERAL ELECTRIC

401-22-5155

WELDING PREHEAT CHART FOR FERROUS AND NONFERROUS METALS

By ROBERT PASS, Engineer, Tempil Corp., New York, N. Y.

Tabulation provides recommended temperatures to which various metals are to be raised prior to welding, in order to reduce or eliminate stresses which may be set up during the welding operation

•

Accompanying list includes metals which come frequently to the attention of the industrial electrical engineer and welding operator. Preheating of the metals before welding has been found to reduce distortion and hardness, to eliminate the danger of formation of cracks, and to reduce or prevent shrinkage stresses.

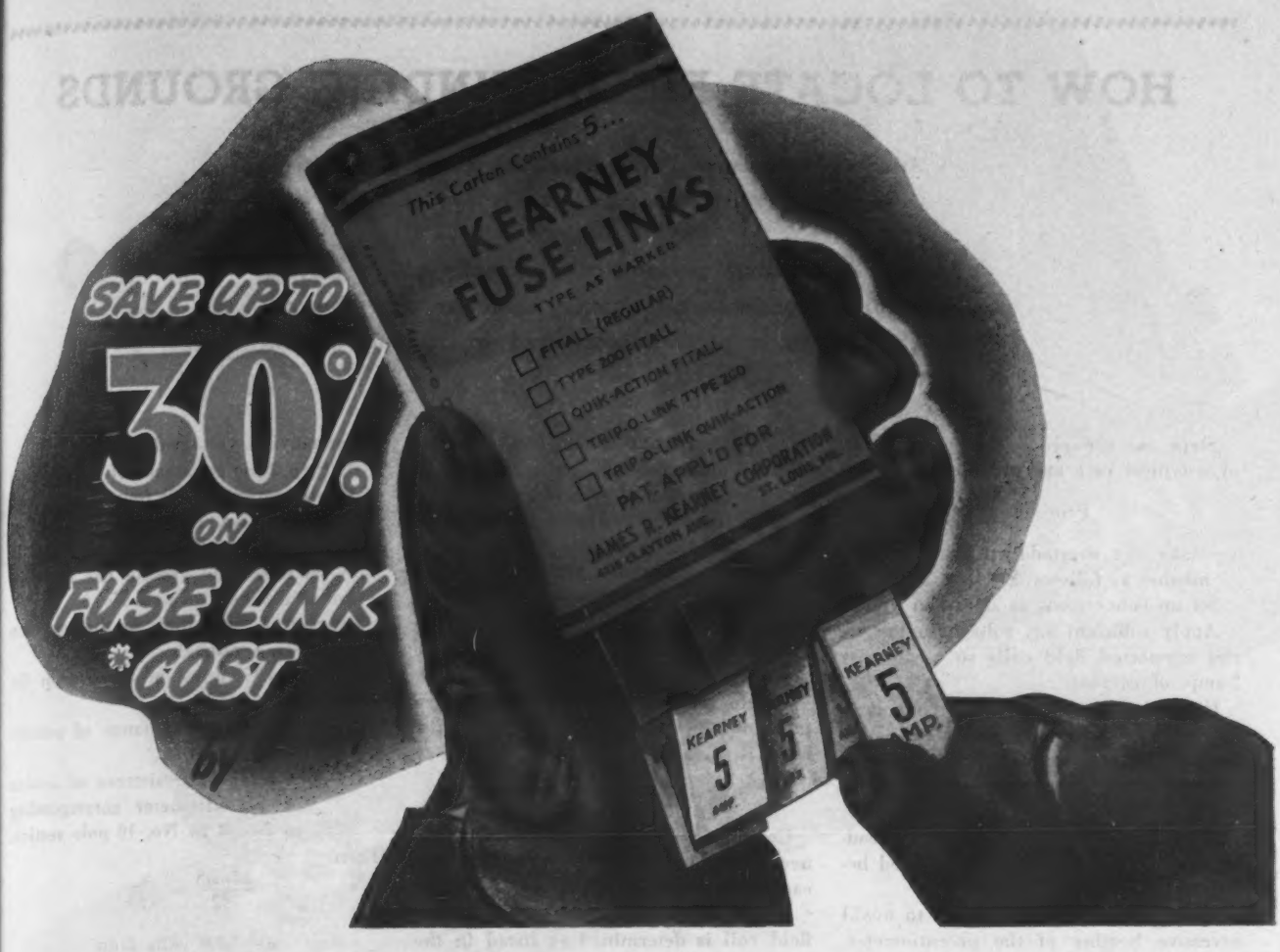
Preheating operation is advantageous and in many cases becomes a necessity when changes occur in factors such as the following:

1. The larger the mass being welded.
2. The greater the difference in mass between the two pieces being joined.
3. The more complicated the shape or section of the parts.
4. The lower the temperature of the pieces being welded.
5. The lower the atmospheric temperature.
6. The smaller the diameter of the weld rod.
7. The greater the speed of welding.
8. The higher the carbon content of the steel.
9. The higher the manganese content of the steel.
10. The greater the alloy content in air hardening steels.

•

Recommended Welding Preheat Temperatures

Metal		Approximate Composition, Percent								Preheat temperature deg. F.
Group	Designation	C	Mn	Si	Cr	Ni	Mo	Cu	Other	
Plain Carbon Steels	Plain carbon	Below 0.20								Up to 200
	Plain carbon	0.20–0.30								200–300
	Plain carbon	0.30–0.45								300–500
	Plain carbon	0.45–0.80								500–800
Carbon Moly Steels	Carbon moly	0.10–0.20					0.50			300–500
	Carbon moly	0.20–0.30					0.50			400–600
	Carbon moly	0.30–0.35					0.50			500–600
Manganese Steels	Silicon structural	0.35	0.80	0.25						300–500
	Mediummanganese	0.20–0.25	1.0–1.75							300–500
	SAE T 1330	0.30	1.75							400–600
	SAE T 1340	0.40	1.75							500–800
	SAE T 1350	0.50	1.75							600–900
	12% manganese	1.25	12.0							Usually not required
High Tensile Steels	Manganese moly	0.20	1.65	0.20			0.35			300–500
	Jalten	0.35 max.	1.50	0.30				0.40		400–600
	Manten	0.30 max.	1.35	0.30				0.20		400–600
	Armco high tensile	0.12 max.				0.50 min.	0.05 min.	0.35 min.		Up to 200
	Double strength No. 1	0.12 max.	0.75			0.50–1.25	0.10 min.	0.50–1.50		300–600
	Double strength No. 1A	0.30 max.	0.75			0.50–1.25	0.10 min.	0.50–1.50		400–700
	Mayari R	0.12 max.	0.75	0.35	0.2–1.0	0.25–0.75		0.60		Up to 300
	Otiscoloy	0.12 max.	1.25	0.10max.	0.10max.			0.50max.		200–400
	NAX high tensile	0.15–0.25		0.75	0.60	0.17	0.15max.	0.25max.	Zr 0.12	Up to 300
	Cromansil	0.14 max.	1.25	0.75	0.56					300–400
	A. W. Dyn-el	0.11–0.14						0.40		Up to 300
	Corten	0.12 max.		0.25–1.0	0.5–1.5	0.55max.		0.40		200–400
	Chrome copper nickel	0.12 max.	0.75		0.75	0.75		0.55		200–400
	Chrome manganese	0.40	0.90		0.40					400–600
	Yoloy	0.05–0.35	0.3–1.0			1.75		1.0		200–600
	Hi-steel	0.12 max.	0.6	0.3 max.		0.55		0.9–1.25		200–500
Nickel Steels	SAE 2015	0.10–0.20				0.50				Up to 200
	SAE 2115	0.10–0.20				1.50				200–300
	2½% nickel	0.10–0.20				2.50				200–400
	SAE 2315	0.15				3.50				200–500
	SAE 2320	0.20				3.50				200–500
	SAE 2330	0.30				3.50				300–600
	SAE 2340	0.40				3.50				400–700
Medium Nickel Chromium Steels	SAE 3115	0.15			0.60	1.25				200–400
	SAE 3125	0.25			0.60	1.25				300–500
	SAE 3130	0.30			0.60	1.25				400–700
	SAE 3140	0.40			0.60	1.25				500–800
	SAE 3150	0.50			0.60	1.25				600–900
	SAE 3215	0.15			1.00	1.75				300–500
	SAE 3230	0.30			1.00	1.75				500–700
	SAE 3240	0.40			1.00	1.75				700–1000
	SAE 3250	0.50			1.00	1.75				900–1100
	SAE 3315	0.15			1.50	3.50				500–700
	SAE 3325	0.25			1.50	3.50				900–1100
	SAE 3435	0.35			0.75	3.00				900–1100
	SAE 3450	0.50			0.75	3.00				900–1100
Moly Bearing Chromium and Chromium Nickel Steels	SAE 4140	0.40			0.95		0.20			600–900
	SAE 4340	0.40			0.65	1.75	0.35			700–900
	SAE 4615	0.15				1.80	0.25			400–600
	SAE 4630	0.30				1.80	0.25			500–700
	SAE 4640	0.40				1.80	0.25			600–800
	SAE 4820	0.20				3.50	0.25			600–900
Low Chrome Moly Steels	2% Cr.–0.5% Mo.	Up to 0.15			2.0		0.5			400–600
	2% Cr.–0.5% Mo.	0.15–0.25			2.0		0.5			500–800
	2% Cr.–1% Mo.	Up to 0.15			2.0		1.0			500–700
	2% Cr.–1% Mo.	0.15–0.25			2.0		1.0			600–800
Irons	Cast iron									700–900
	Ni resist									500–1000
Non-ferrous	Aluminum									500–700
	Monel									200–300
	Nickel									200–300
	Inconel									200–300
	Copper									500–800
	Zinc									200–300



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**Figures show as high as 30% fuse link loss with old-time bulk packaging.*

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HOW TO LOCATE FIELD WINDING GROUNDS

As used and recommended by A. A. STRAUB, Substation Engineer
Southern California Edison Co., Ltd., Los Angeles, Calif.

Method of locating grounds in field coils of generators, synchronous condensers, frequency changers, and other apparatus, using a potentiometer and alternating current

Steps for the procedure and solution of a typical case are presented.

Procedure

1—Make the shorted-turn test in usual manner as follows:

Set up connections as shown in Fig. 1.

Apply sufficient a.c. voltage to the series connected field coils so as to pass 2-amp. of current.

Hold the current constant and read voltage drop across each field coil.

2—Make resistance ratio test as follows:

Set up a bridge circuit as in Fig. 2, using a 72-ohm, 3-amp. potentiometer.

Adjust potentiometer to give zero reading on voltmeter which is connected between the slide and the ground.

Hold current at one ampere to avoid excessive heating of the potentiometer. Open switch to a.c. voltage source when zero value is obtained on the voltmeter.

Measure resistance of each section of potentiometer.

3—Determine location of ground as follows:

Use equation and solve for x:

$$\frac{a}{b} = \frac{x}{c}$$

where

a = Volts drop over entire field
b = Resistance of potentiometer
c = Resistance of one section of potentiometer
x = Location of ground in volts drop from one end of series-connected fields.

Calculate resistance (R_1) between adjacent pole and accidental ground.

Knowing the number of turns in the grounded coil, determine the voltage drop (r_1) per turn.

Locate the ground on the respective turn of the field coil, by using the ratio R_1/r_1.

Example

Consider a series of 10 field poles connected as shown in Fig. 1 and 2, and each pole having 100 turns.

By Step 1 the voltage drop across each field coil is determined as listed in the accompanying voltage-drop table.

Voltage Drop for Each Field Coil Current Held at 2 Amp.

Pole	Volts	Pole	Volts
1	32.5	6	44.0
2	41.7	7	44.5
3	42.0	8	35.75
4	42.0	9	17.4
5	42.0	10	34.5
		Total	386.35

By Step 2 the resistance of each section of the potentiometer is found to be 62.15 ohms for the No. 1 to No. 8 pole section and 9.85 ohms for the No. 8 to No. 10 pole section. The ground has been determined as being in pole No. 8.

By Step 3, substitute in the equation the following values:

a = 386.35 units of volts drop for entire field
b = 72 ohms, resistance of potentiometer
c = 9.85 ohms, resistance of section of potentiometer corresponding to No. 8 to No. 10 pole section.

Then

$$\frac{386.35}{72} = \frac{x}{9.85}$$

or

$$x = 52.8 \text{ volts drop.}$$

Units of volts drop in No. 9 and 10 poles (data from table) is 34.5 + 17.4 or 51.9, and between No. 9 pole and accidental ground is 52.8 —51.9 or 0.9 units.

Since each pole has 100 turns, No. 8 pole has 35.75 units drop or 0.3575 unit per turn.

By using the ratio R_1/r_1, the ground is calculated to be 0.9/0.3575 or 2.5 turns in No. 8 pole from No. 9 pole.

Hence the ground was located on the third turn from No. 9 end of No. 8 pole.

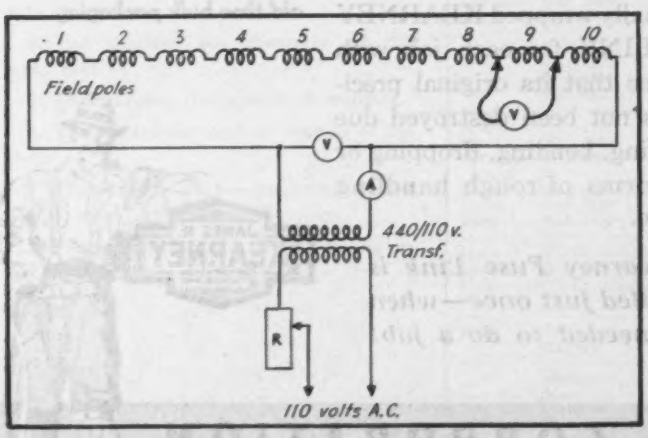

FIG. 1—Connections for voltage drop of field coils

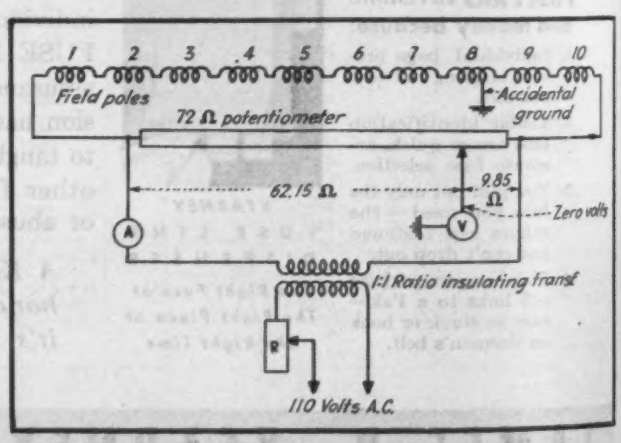

FIG. 2—Connections for bridge circuit

POSITIVE PROTECTION

AFFORDED BY JOSLYN ARRESTERS

APPLIES TO BOTH OLD AND NEW EQUIPMENT

THE OLD TIMER shown here has been neglected for many years, but by actual test Joslyn Arresters were found to provide a 30% impulse protective margin in spite of low oil level, sludge and dirty bushings. There are thousands of old transformers now being protected by Joslyn Arresters, which are proving their effectiveness not only by saving these old timers from lightning failures but by holding storm outages of fuses to a minimum. 60 to 80% reduction in such outages have been recorded on lines where other devices have been replaced by Joslyn Arresters. This is proof of higher protective efficiency.

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20 NORTH WACKER DRIVE, CHICAGO 6, ILL.

Determine Limitation of Standard Sag Formula

By CONRAD SEDERLUND
Electrical Engineer,
United States Naval Air Station,
Quonset Point, R. I.

Standard formula, $T = WL^2/8S$, as given in text books, for tension in wire spanning between poles is sufficiently correct for ordinary use. Sags are usually measured in a small percentage of the span length, but occasionally there are instances where greater sags occur, such as stretching caused by ice load on the wire or considerable sag of heavy cable on purposely slack short spans. In such instances it is well to know how to determine accurately the tension on wire.

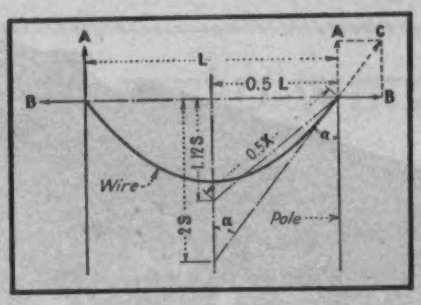
To show the percentage errors of the formula, and that the computed value of tension can be erroneous to a rapidly increasing degree as the sags are increased, the accompanying table has been prepared.

This method of calculating tension is sufficiently accurate to use in any problems where wire, chains, cable, or rope are used, providing the sag is not greater than 50 percent of the span.

Referring to the table, the length of wire is obtained from the approximate relationship that the length of wire equals

$$2\sqrt{(1.12 \text{ sag})^2 + (0.5 \text{ span})^2}$$

which is simple to use and approximately accurate for sags less than 50 percent of the span, more accurate than the usual simplified formulae for determining the length of wire.



REPRESENTATION of values in table

In the table a method is shown for obtaining accurate results, if necessary, and a diagram indicates the basis of calculations. These calculations are based on a parabola which is accurate to ½ of 1 percent of the true catenary curve which a wire actually forms when hanging between two points.

Wire tension C on diagram is resisted by two forces: (A) the vertical weight of the pole; (B) the horizontal tension from the continuing wire or anchor guy.

The standard formula gives only the horizontal tension which on small percentage sags is approximately equal to B, the horizontal tension.

•

Foot Switch and Brake Aid Production, Safety

Modifications primarily of electrical control for a Farnham roll forming machine have tripled the productivity of the equipment used to produce cylindrical contours in heat treated aluminum alloy sheet at the Glenn L. Martin Co. plant, Baltimore, Md. In addition a serious safety hazard has been eliminated, scrap losses have been reduced to zero due to ease of accurate stopping, and the operation of the machine has been simplified sufficiently to permit the use of semi-skilled operators. The modifications were designed by the Tool Design Electrical Group under direction of Paul H. Merriman.

Three principal changes were:

1. Foot switch has been substituted for the old rope control to stop, start and reverse the motor. It gives the operator positive control while freeing his hands at all times. For a description of this foot switch see ELECTRICAL WORLD, March 3, 1945, page 116.

2. A solenoid brake has been added for instantaneous stopping at any point. Leather faces are used rather than brake lining to permit very rapid stopping.

3. Remote safety stop and lockout buttons have been installed at convenient points along the length of the machine to permit its safe use by more than one operator.

The forming machine was controlled originally by a rope extending the full length of the machine and connected to a reversing drum switch near the motor. The drum switch did not have a "spring return to off."

To operate the machine in either direction the operator had to pull the rope in the desired direction.

ADDITION of foot switch, reversing magnetic contactor, solenoid brake, and safety stop and lockout buttons simplified operation of roll forming machine

Error of Standard Formula $T = WL^2/8S$ for Tension on Wire

(Using a parabola based on 100-ft. span; total weight of wire 2 lb. per ft.)

Sag, ft.	Length of Wire, X, $= 2\sqrt{(1.12S)^2 + (0.5L)^2}$ ft.	Parabolic Formula: $\frac{0.5L}{2S} = \tan\alpha$	Angle α	Parabolic Formula: $\frac{XW}{2\cos\alpha}$	Tension, lb.	Standard Formula: $\frac{WL^2}{8S}$	Tension, lb.	Error, %
2	100	$\frac{50}{4} = 12.5$	85–26	$\frac{100 \times 2}{2 \times 0.0796}$	1256.2	$\frac{2 \times 100^2}{8 \times 2}$	1250	0.5
4	100	$\frac{50}{8} = 6.25$	80–55	$\frac{100 \times 2}{2 \times 0.1579}$	633	$\frac{2 \times 100^2}{8 \times 4}$	625	1.3
6	$2\sqrt{6.72^2 + 50^2} = 100.9$	$\frac{50}{12} = 4.17$	76–31	$\frac{100.9 \times 2}{2 \times 0.2332}$	433	$\frac{2 \times 100^2}{8 \times 6}$	417	3.84
8	$2\sqrt{8.96^2 + 50^2} = 101.6$	$\frac{50}{16} = 3.125$	72–15	$\frac{101.6 \times 2}{2 \times 0.3049}$	333	$\frac{2 \times 100^2}{8 \times 8}$	312.5	6.56
50	$2\sqrt{56^2 + 50^2} = 150$	$\frac{50}{100} = 0.5$	26–34	$\frac{150 \times 2}{2 \times 0.8944}$	168	$\frac{2 \times 100^2}{8 \times 50}$	50	236.

LEGEND: L = Span, in feet; X = Length of wire, in feet; S = Sag, in feet; α = Angle of wire with pole; W = Total weight of wire, pounds per foot; T = Tension of wire at pole, in pounds.

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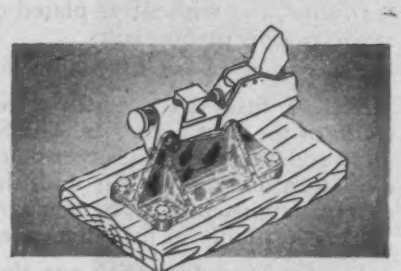
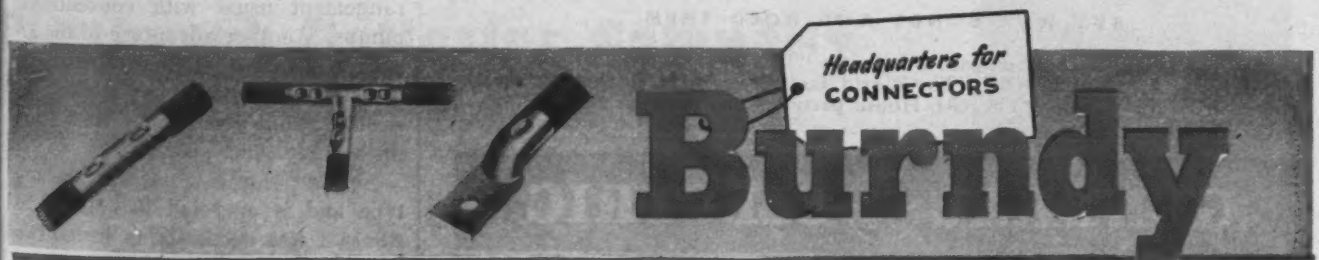
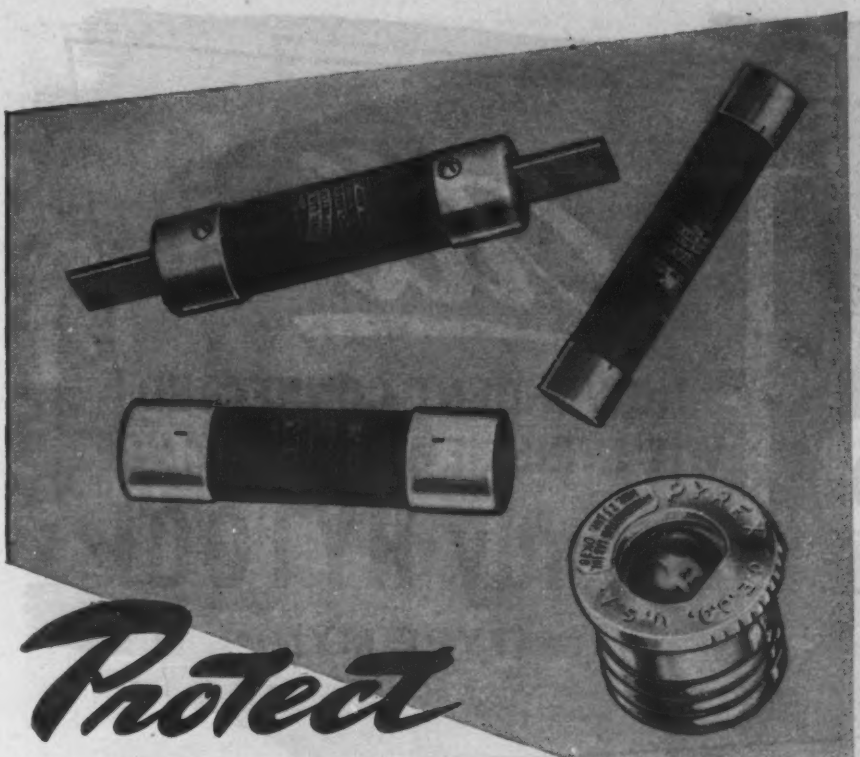


Adaptor for converting portable MY to bench press





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For further information see the nearest G-E Merchandise Distributor or write to Section D452-9, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

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GENERAL ELECTRIC

If the operator released the rope the rolls continued to turn and easy stopping control of the machine was lost. This represented a safety hazard.

A further difficulty arose from the fact that when the rope was pulled and the drum switch turned to the "off" position, the motor would coast for a considerable period unless the rope was pulled to full reverse position and then back to "stop" at the instant the motor came to rest. This method of control added to the safety hazard and also necessitated a great degree of skill on the part of the operator in order to stop the machine within a fraction of an inch of specified points while the work was passing through the rolls.

Since the modifications were made, no accidents have been reported on the machines. Installation procedure required four steps:

1. Removal of rope control and replacing of drum switch with reversing magnetic contactor.
2. Installation of solenoid brake on motor shaft.
3. Installation of control wire conduit along front of machine with outlets for stop button and foot switch cables.
4. Wiring of foot switches and stop buttons into control.

Cost of the modification was relatively low since the necessary parts were available in the maintenance shop.

•

Transfers Oil with Reversible Gear Pump

One of the substation maintenance trucks of Northern Indiana Public Service Co., Hammond, is equipped with a positive-pressure type, gear pump driven from the truck's power take-off and used for transferring oil either from station equipment into drums on the truck or from drums on the truck into equipment. Since the power take-off is reversible, and the pump a gear type, it can operate in either direction without need of the complicated valve and piping arrangement usual with conventional pumps. Another advantage of the arrangement is that the oil can be transferred almost in any manner desired without removing drums from the truck.

As the pump is a positive pressure type and is operated in both directions, it was necessary to install two

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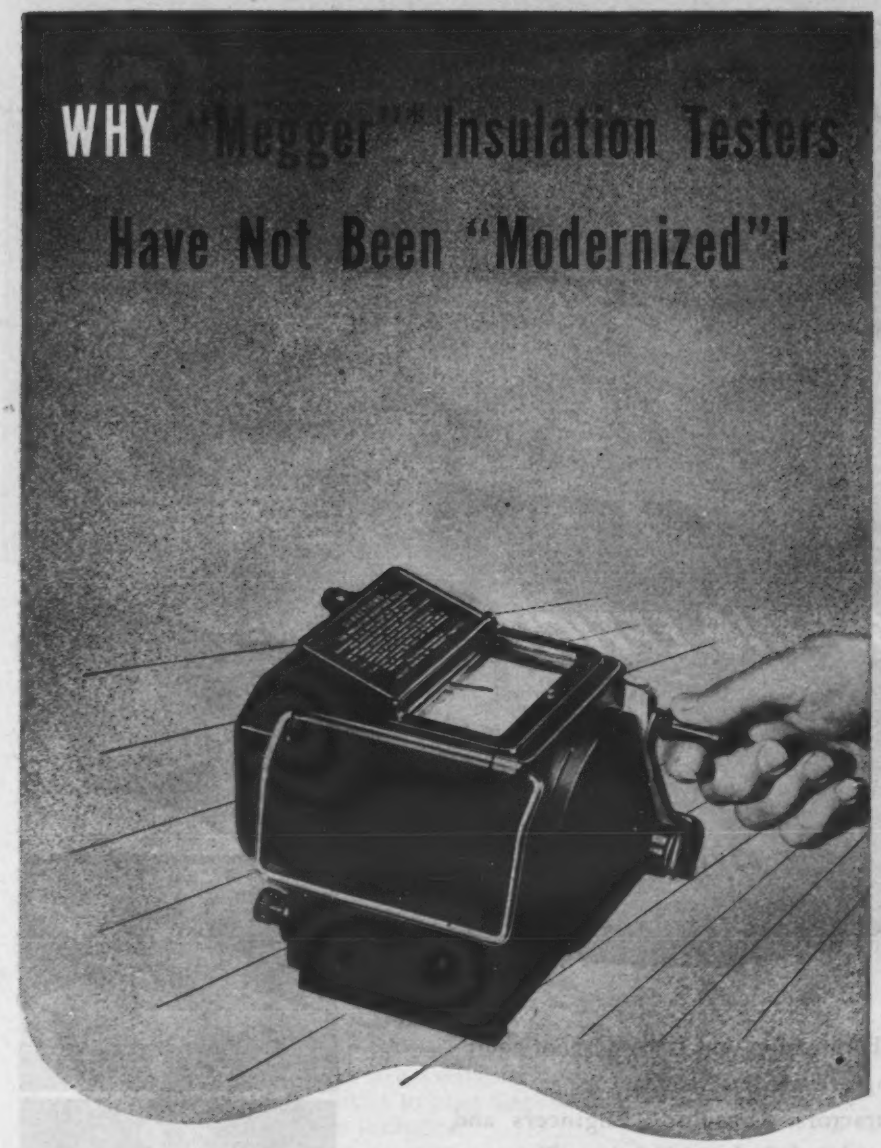

You may have wondered why we have not departed from the original operating principle of "Megger" insulation testing instruments—why we have not changed from hand operation to battery operation, or have not made use of electronic tubes or other devices. The reason is simple.

Ours is the business of building and supplying insulation testing instruments that can be depended upon to operate accurately and unfailingly—anytime and anywhere. To that end we have naturally considered, investigated and tested every element that might effect improvement. Years of research and the performance records of many thousands of "Megger" instruments have demonstrated that the classic simplicity of the "Megger" Insulation Tester with its hand-cranked generator and complete independence of any parts requiring replacement or adjustment is the best assurance of sustained, trouble-free, dependable service. "Megger" insulation testing instruments have been and will continue to be built to the high standards of fine instrument making practice.

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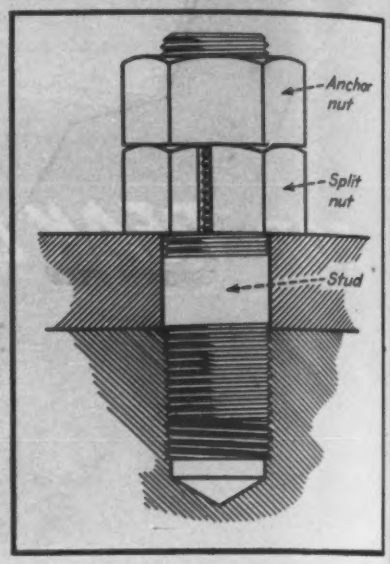
by-pass relief valves connected in opposite directions. Otherwise, if discharge valves should be closed with the pump in operation the pressure developed might wreck the pump.

•

Self-Locking Nut Aids Stud Removal

A self-locking jam nut is used to remove studs without damaging the threads. The illustration exemplifies



STUD REMOVING simplified by split nut which binds to stud threads

the application at General Electric's Erie Works.

Two standard nuts—one slotted lengthwise—are backed against each other. The pressure of a wrench on the split nut binds it to the stud threads, providing extra friction by which the stud may be removed. The second nut is used as an anchor.

•

Vector Analysis of Meter Connections—II*

By NICHOLAS B. COOK*

Public Service Electric & Gas Co., Paterson, N. J.

The vectorial solution of the average torque or registration of an incorrect meter connection will be the subject of this article. For this problem the current connection has incorrectly been shifted counterclockwise 120 electrical deg. from the correct connections discussed in ELECTRICAL WORLD April 14, 1945, page 122. Potential connections also have been reversed at both potential transformers.

* Series began in the ELECTRICAL WORLD, April 14, 1945.

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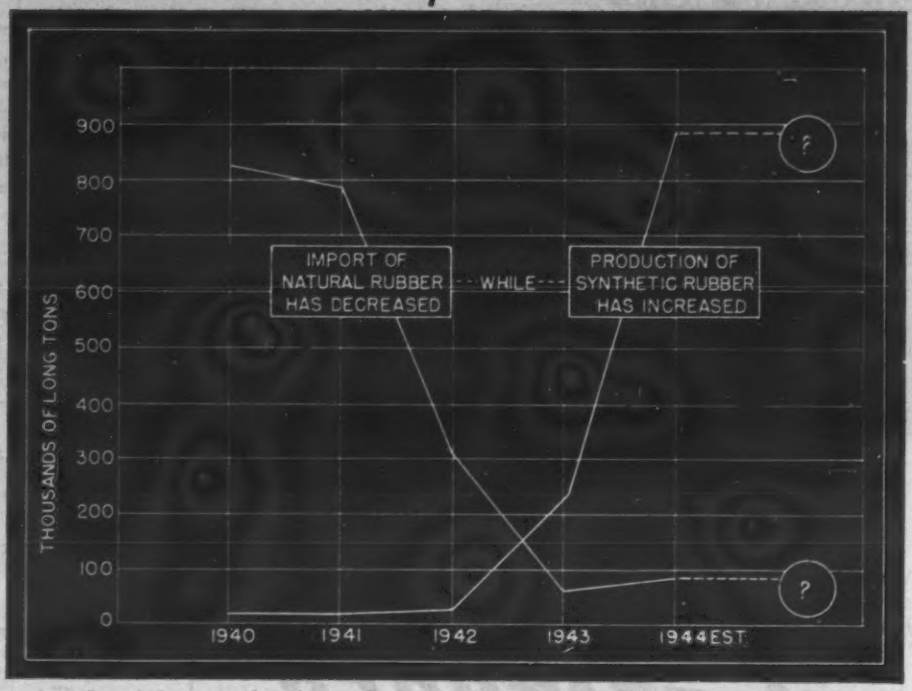

The results obtained with synthetic rubber compounds that have replaced our many prewar, special purpose, natural rubber insulations and sheaths have exceeded our expectations. As long as only synthetic rubbers are available, we shall produce the best possible product with synthetics. When natural rubber is again available we shall recommend the type of cable insulation most suitable for efficient, trouble free service.

Synthetic compounds will have some postwar uses that natural rubber cannot match. In such fields they will continue to be preferred but for many types of service the natural rubber compounds will again be first choice. Relative availability and cost, political and industrial restrictions and national security will have a bearing on the future of the two products.

There will be a postwar place for both natural and synthetic rubbers. The inevitable postwar expansion of the electrical industry promises a big future for all types of insulated wires and cables, each having certain fields of usefulness in which it excels.

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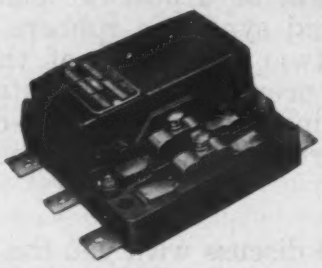
4 FEATURES

OF THE ASCO "TYPE RC" REMOTE CONTROL SWITCH

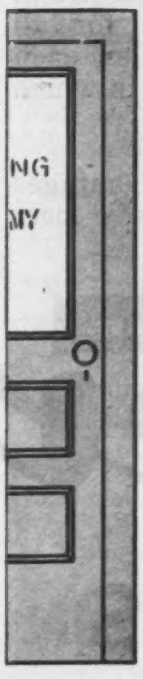


1 Single operating coil energized momentarily—surge of power operates switch.

2 Mechanically locked open or locked closed by linkage—no delicate hooks or latches.

3 No AC hum or chatter; no holding coils with attendant losses.

4 Contacts cannot weld closed—equal surge of power opens and closes.



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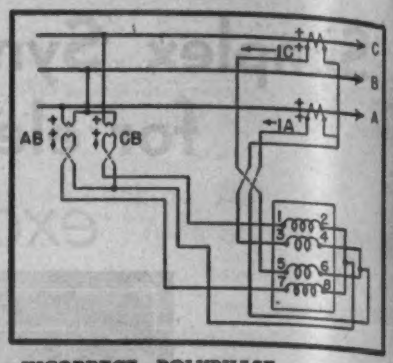


INCORRECT POLYPHASE meter connection with current leads 120 electrical degrees displaced and potential leads reversed at both transformers

By applying the principles discussed in the previous article the following equations may be written:

In upper element:

$$-E_{12} - E_{CB} = 0$$
$$E_{12} = E_{BC}$$
$$I_{34} = -I_A - I_C = I_B$$

In lower element:

$$-E_{78} - E_{AB} = 0$$
$$E_{78} = E_{BA}$$
$$I_{56} = I_C$$

The vectors represented by the foregoing equations may readily be determined. At unity power factor and balanced load,

$$P_{upper} = EI \cos 30° = \frac{\sqrt{3}}{2} EI$$

$$P_{lower} = EI \cos 90° = 0$$

$$P = \frac{\sqrt{3}}{2} EI + 0$$

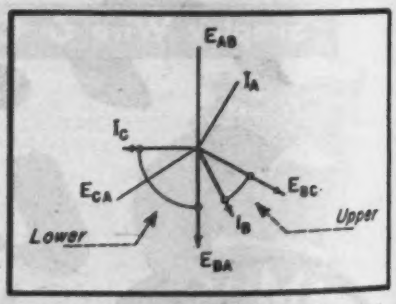
Since P should be equal to $\sqrt{3}EI$,

$$\text{Percent registration} = \frac{\frac{\sqrt{3}}{2} EI}{\sqrt{3}\, EI} \times 100 = 50$$

With a lagging power factor each current vector will lag its voltage vector still more and the respective angles will be increased by θ. Assume a lagging power factor in which θ is equal to 30°. Then

$$P_{upper} = EI \cos 60° = \tfrac{1}{2} EI$$
$$P_{lower} = EI \cos 120° = -\tfrac{1}{2} EI$$

Since $\frac{1}{2} EI + (-\frac{1}{2} EI) = 0$, the average torque under these conditions is zero and the registration is zero percent. In a similar manner the registration may be computed for any power factor, lagging or leading.



VECTORIAL ANALYSIS of incorrect meter connection

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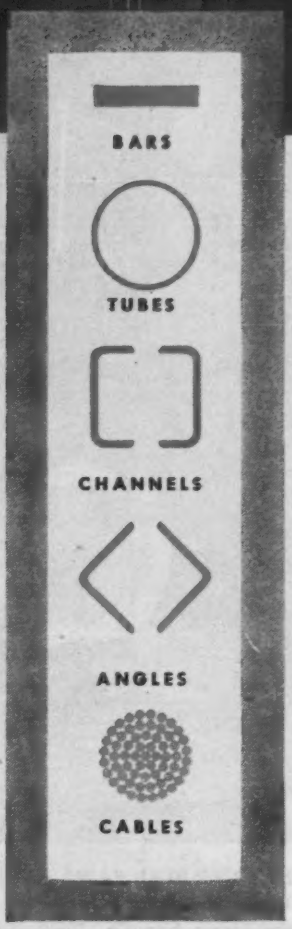

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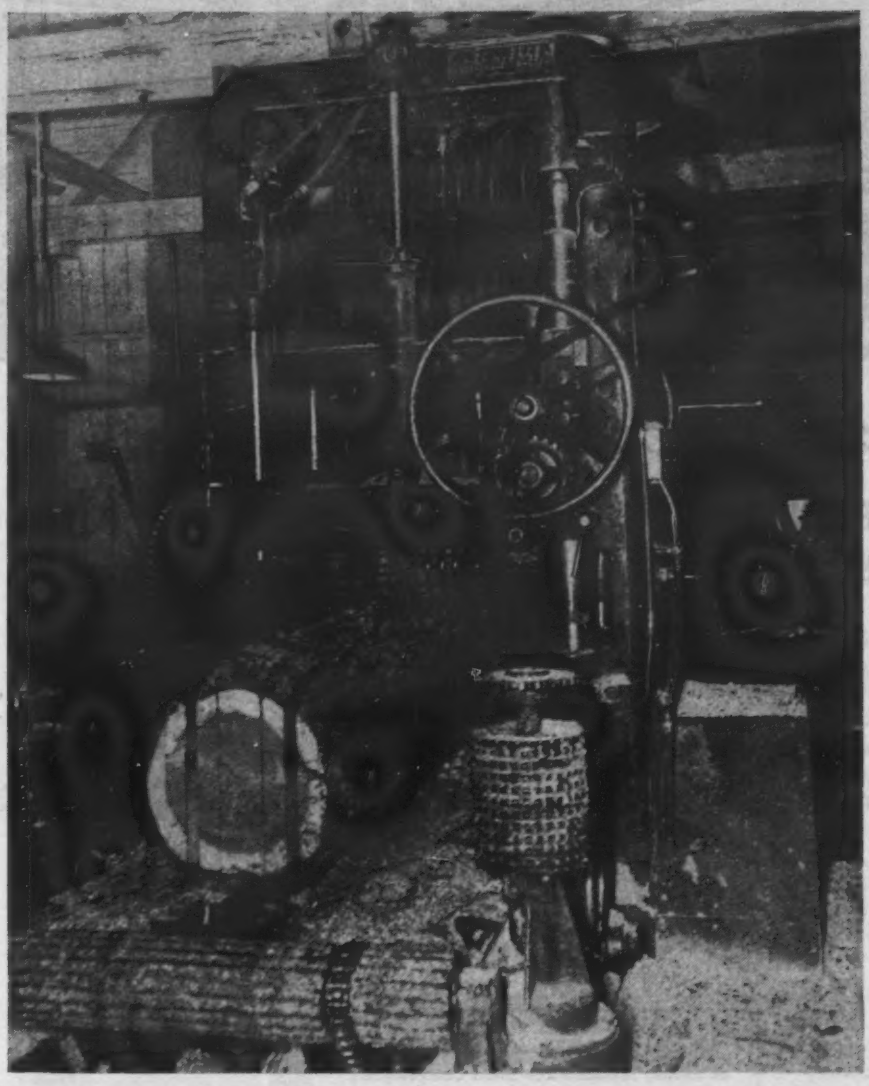

SWEDISH HEAD SAWS are now beginning to be used in the lumber industry of the Pacific Northwest to make it economical to saw small logs. Installation shown is at the Stebco Mfg. Co., Vancouver, Wash.

A number of parallel saw blades are mounted in a frame and driven in a jig-saw fashion by a 150-hp., 440-volt, squirrel cage motor so that the log is cut into cants, or slabs, in one passage through the saw, instead of cutting one cant at a time as done with the usual circular or bandsaw head rig. Logs being cut at the Vancouver mill range in size from 10 to 20 in. in diameter and 12 to 20 ft. in length. Significance of the appearance of this type of saw in the Northwest is that much of the larger timber has been logged off and it is becoming necessary to start cutting the much smaller, second growth timber

Utility Group Sponsors Farm Research Fellowship

By A. F. HERWIG
Executive Secretary
Wisconsin Utilities Assn., Milwaukee, Wis.

Can farm production be increased and labor and investment reduced by electrical mechanization of farm chores? Is it impossible for chore time on farms, now taking 50 to 55 percent of a farmer's time, to be cut in half by the economic use of light, heat and power to dairy farming? Will modernization and simplification of farm barns improve labor efficiency?

Answers to these questions and others like them are to be dug out in a four-year research program provided for in an industrial fellowship agreement recently approved between the Wisconsin Utilities Association and the University of Wisconsin's College of Agriculture. Under the agreement the university will receive $52,000 for expenses in conducting research in the "economic use of electric light, heat and power for all phases of the dairy farmstead, with the purpose of saving labor, improving the quality of the milk produced and reducing the costs of milk production."

Investigations are to be undertaken on a 144-acre farm about five miles from Madison, Wis. They will begin as soon after April 1 this year as the wartime emergency will permit.

Establishment of this latest Wisconsin farm research fellowship follows the pattern of other research work conducted by the University under successive fellowships established by the Wisconsin Utilities Association 20 years ago which pioneered rural electrification in Wisconsin and paved the way for present farmer acceptance of electrification.

Dairy Studies

First phase of the current investigation, according to university officials, will include time-and-cost studies of methods dairy farmers now use in doing chores. Using the records so obtained for comparison, buildings will be erected and remodeled and test equipment installed to determine how present methods can be improved.

Interest in the project is spurred by conviction that many farmers will want to remodel or build dairy barns after the war and will need informa-

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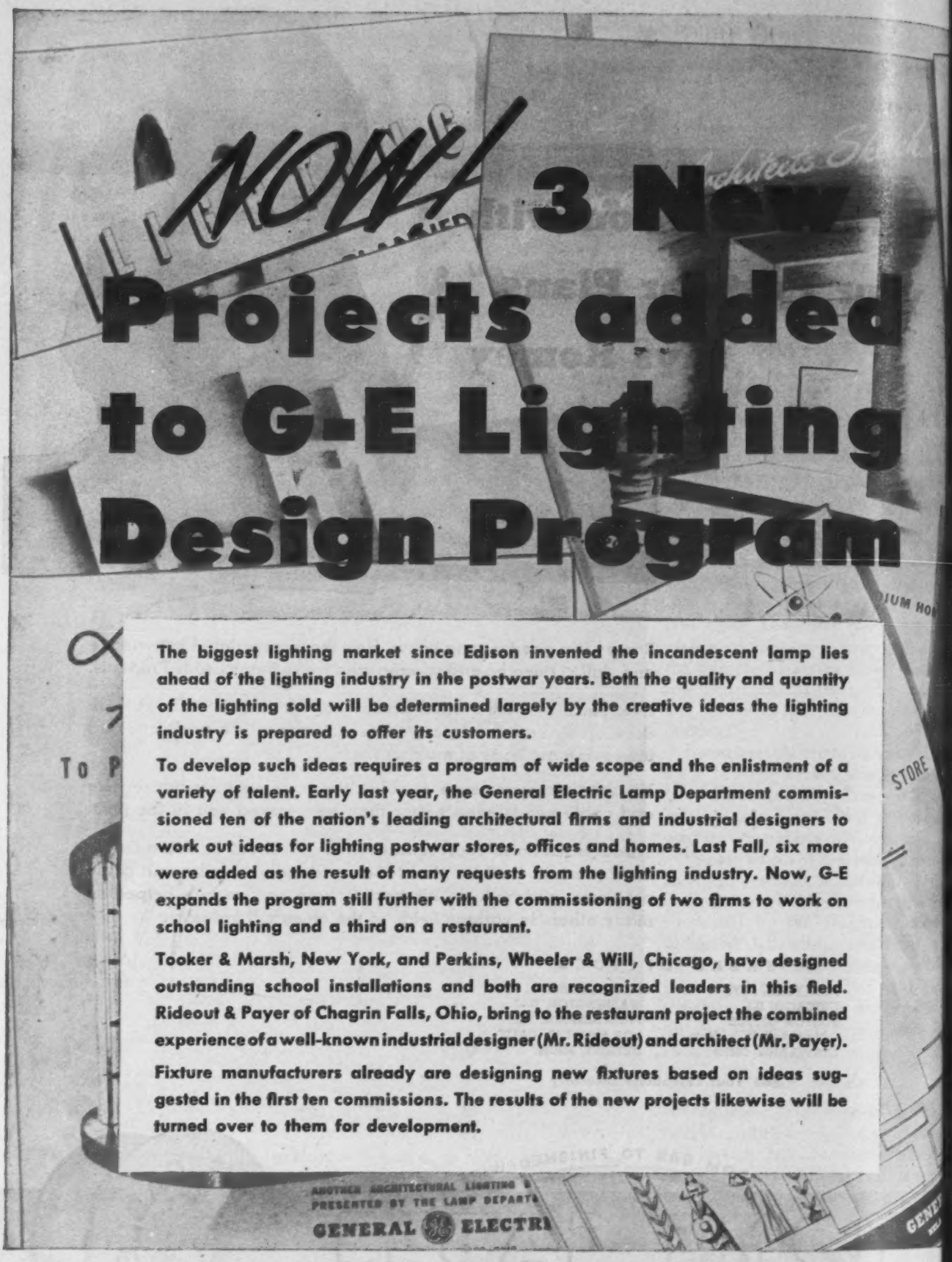
NOW!
3 New Projects added to G-E Lighting Design Program
The biggest lighting market since Edison invented the incandescent lamp lies ahead of the lighting industry in the postwar years. Both the quality and quantity of the lighting sold will be determined largely by the creative ideas the lighting industry is prepared to offer its customers.
To develop such ideas requires a program of wide scope and the enlistment of a variety of talent. Early last year, the General Electric Lamp Department commissioned ten of the nation's leading architectural firms and industrial designers to work out ideas for lighting postwar stores, offices and homes. Last Fall, six more were added as the result of many requests from the lighting industry. Now, G-E expands the program still further with the commissioning of two firms to work on school lighting and a third on a restaurant.
Tooker & Marsh, New York, and Perkins, Wheeler & Will, Chicago, have designed outstanding school installations and both are recognized leaders in this field. Rideout & Payer of Chagrin Falls, Ohio, bring to the restaurant project the combined experience of a well-known industrial designer (Mr. Rideout) and architect (Mr. Payer).
Fixture manufacturers already are designing new fixtures based on ideas suggested in the first ten commissions. The results of the new projects likewise will be turned over to them for development.
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The research project will be conducted under the supervision of F. W. Duffee, university agricultural engineer and I. W. Rupel, dairy husbandman. Duffee and Rupel will be assisted by a faculty advisory committee made up of P. E. McNall and W. W. Wilcox, agricultural economics department; B. A. Beach, veterinary science; S. A. Witzel, agricultural engineering; H. L. Ahlgren, agronomy and R. J. Muckenhirn, soils.

Program

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1. Review of the H. B. White thesis "Recent Farm Work Simplification" and other studies on barn layout as related to labor efficiency.

2. Study and analysis of best dairy barn design as related to mechanization and labor efficiency.

3. Construction of new barns and outbuildings designed to:

a. Incorporate the maximum of electrically operated labor saving equipment.

b. Permit maximum change at minimum expense so studies of various types of equipment and arrangements may be made.

c. Major part of the study will be applied to conventional stanchion-type barn.

d. A one-story barn will probably be constructed; it is easier to change and cheaper to construct.

e. Possibly short section of a barn can be used for some of the preliminary studies.

f. A grain storage and processing building will be constructed, equipped and located for maximum efficiency.

g. Grain handling and processing equipment will be studied.

h. Manure handling equipment will be studied, additional equipment developed and installed if necessary.

i. Hay and bedding handling will be investigated and additional equipment developed and installed if necessary.

j. A milk room will be constructed incorporating the maximum of labor saving equipment.

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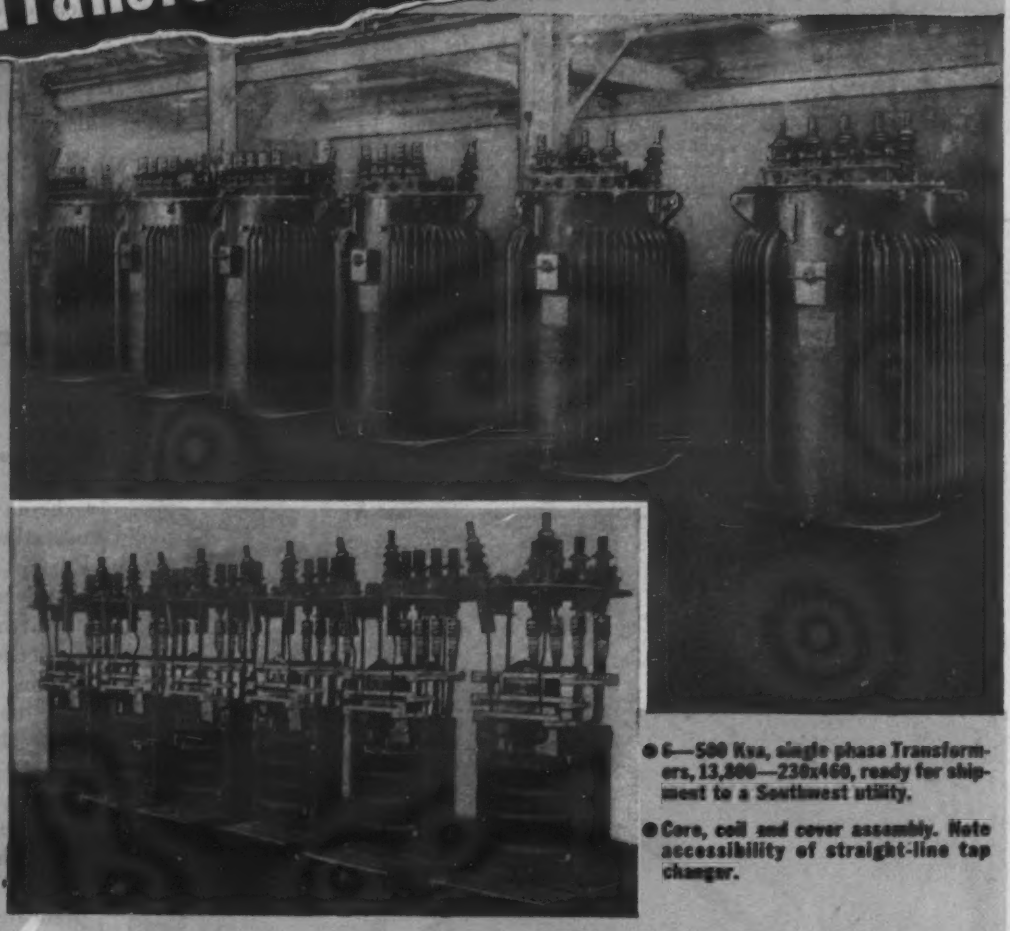

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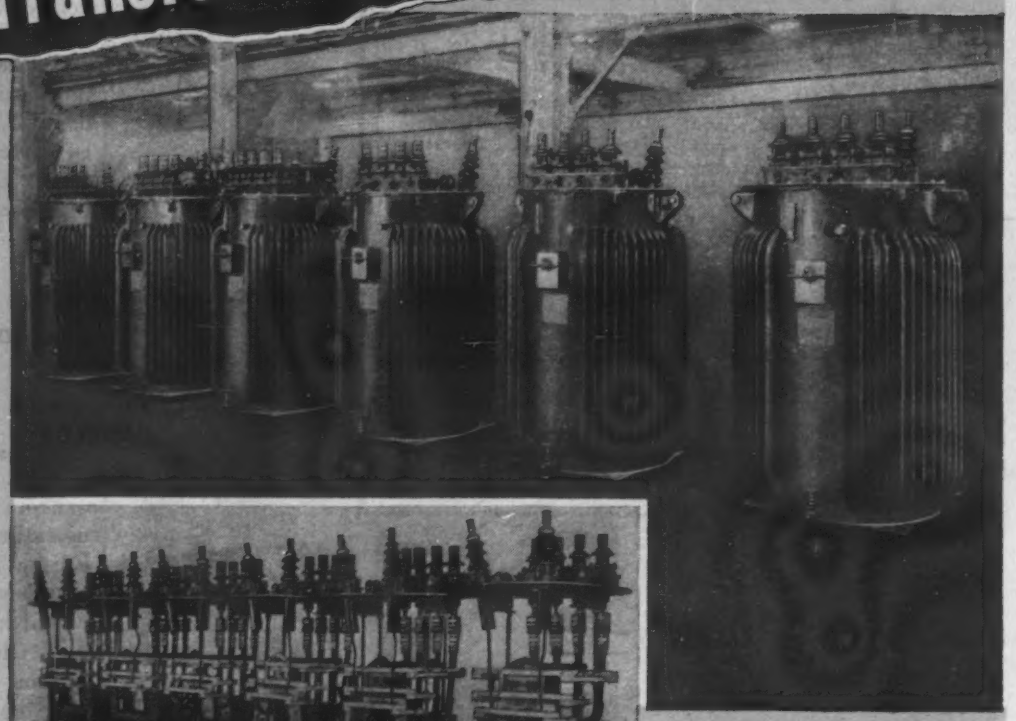

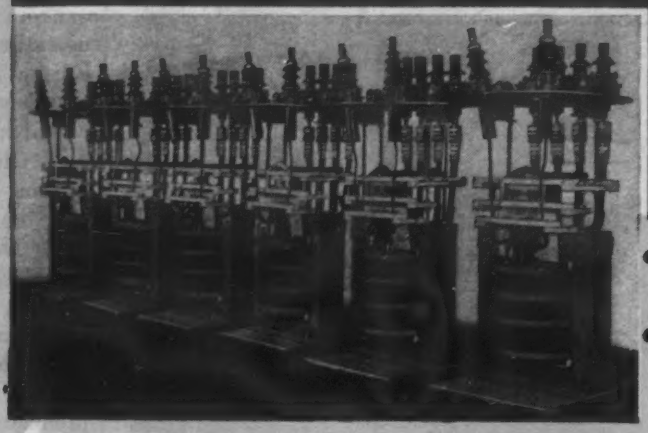

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ship agreement for the investigations not more than $46,000 is set up for the farm, experimental barns, equipment and livestock; and a maximum of $10,000 is provided for farm operating expenses.

Negotiation of the fellowship agreement with the College of Agriculture officials of the University of Wisconsin was done by the following representatives of the Wisconsin Utilities Association: S. B. Sherman, association president and vice-president of the Wisconsin Gas & Electric Co.; C. E. Kohlhepp, vice-president and general manager, Wisconsin Public Service Corp.; G. C. Neff, president, Wisconsin Power & Light Co.; G. V. Rork, president, Northern States Power Co. and A. F. Herwig, executive secretary of the association.

•

Uncommon Uses for H. F. Heating—II*

By E. D. TILLSON,
Testing Engineer,
Commonwealth Edison Co., Chicago, Ill.

From among 200 materials and parts brought to the Commonwealth Edison Laboratories by industrial customers for experimentation in the use of high frequency induction and dielectric heating, 14 interesting applications have been selected to illustrate the flexibility of this new heating tool. These cases, of which two have already been published (ELECTRICAL WORLD, April 14, 1945, page 148), are described in a series of articles of which this is the second.

Case 3—Small armatures can be preheated by induction methods before dipping in insulating varnish. In this case the armature was baked afterward also by induction heating at 240 deg. F. A six turn coil was used. One minute was required for preheat, and for baking two minutes with power on. This brought the piece to curing temperature after which baking occurred from residual heat. This contrasts with eight to ten hours necessary in a convection oven. There is a considerable list of industrial materials that must be impregnated, including anything from roofing felt to transformer coils. In every case heating before impregnation increases penetration and after impregnation

* Based on paper presented by the author before "High Frequency Heating Conference" sponsored by Great Lakes Power Club and Chicago Lighting Institute.

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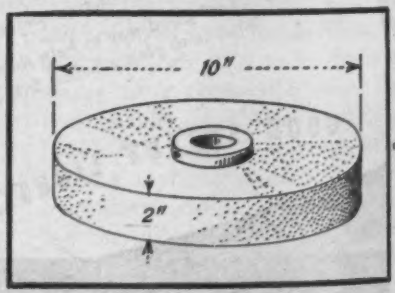
CASE 3—Armatures heated before impregnation and baked afterward by high frequency induction heating

heating prevents case hardening.

Case 4—Many abrasive wheels were submitted for cure or polymerization of the binding resin. One fair sized wheel is shown. In this case some difficulty was experienced due to swelling but otherwise an acceptable curing job was done. It is believed that if the wheel was retained between two perforated Transite plates and a perforated Transite ring was used for the periphery, the moisture would escape without causing swelling. It has not been possible to retest this particular wheel but others have been successfully cured without distortion. The temperature depends on the resin used. It may range from 150 to 350 deg. F. Aluminum oxide is frequently employed as the abrasive. This wheel was heated dielectrically for 10 min.; alternative method required 36 hr.



CASE 4—Bond abrasive wheel with dielectric heat

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Assembled connector design is such that the parts do not become detached. This is said to permit ease of installation on energized lines with standard hot line tools and socket attachments to fit heads of the cap screws. It will accommodate two conductors of their rated size or one conductor of their rated size with one or more smaller tap-off wires, down to No. 8 solid. The slight bending of the upper clamping member is said to prevent the connector from becoming loose.

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Panel Instruments

Hermetically sealed panel instruments: 2½ in. size; d.c. voltmeters, ammeters and a.c. radio-frequency ammeters. General Electric Co., Schenectady 5, N. Y.

Hermetically sealed panel instruments (d.c. voltmeters, ammeters and a.c. radio-frequency ammeters) are housed in steel cases and said to be immune from effects of moisture, humidity, chemical fumes and other harmful agents. Instruments are made in all standard ratings mentioned in, and conforming to performance requirements of, American War Standards A.S.A. specifications C-39.2-1944. Units are said to withstand thermo-shock test of ten alternate exposures to salt water at 85 deg. C and then at zero deg. C, without evidence of moisture penetration or damage to finish or enclosure.

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Brush holder; stud mountings ½ to ⅞-in. diameter. Publix Metal Products, Inc., 100 Sixth Ave., New York 13, N. Y.

Holder is fabricated from heavy sheet brass. Clamp mounting on the stud is said to eliminate the necessity of close tolerance on stud diameter and to permit use of commercial bar stock. Stop screw is said to prevent displacement of brush under shock. Cotter pin and slip stud are reported to allow easy spring replacement.

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BUYING ELECTRICAL EQUIPMENT?— McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Heat Recovery Silencer

"Vortex" heat recovery silencer for diesels. Engineering Specialties Co., Inc., 39 Cortland St., New York 7, N. Y.

Unit is designed for utilization with both marine and stationary installation. It is reported to combine four functions in the one construction—steam generation up to 30 psi-, hot water heating, exhaust silencing and removal of sparks and carbon from exhaust gases.

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Conduit Bushing

Type "SBT" insulated bushing for thin wall conduit. O. Z. Electrical Mfg. Co., Brooklyn, N. Y.

Bushing is made in six sizes for use with thin wall conduit from ½ in. to 2 in. in diameter. The body of the casting is made of malleable iron and is cadmium plated. The bushing is fastened to the conduit by case-hardened cup-point set screws.

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Variable Transformers

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As the load is increased at "A" beyond normal strain, the base starts to "bow" up slightly at "D". Immediately the shoulders at "B" and "C" are drawn in against the bail "E", gripping it over a fairly large area, like the jaws of a vise. The harder the pull, the tighter the grip until the ultimate of the bail wire is reached.

*Tests have shown that before the bail breaks the normal mounting would long since have pulled loose. Attached to a solid beam of hard wood one Hubbard 4-11-44 Wireholder will support the weight of a light automobile.

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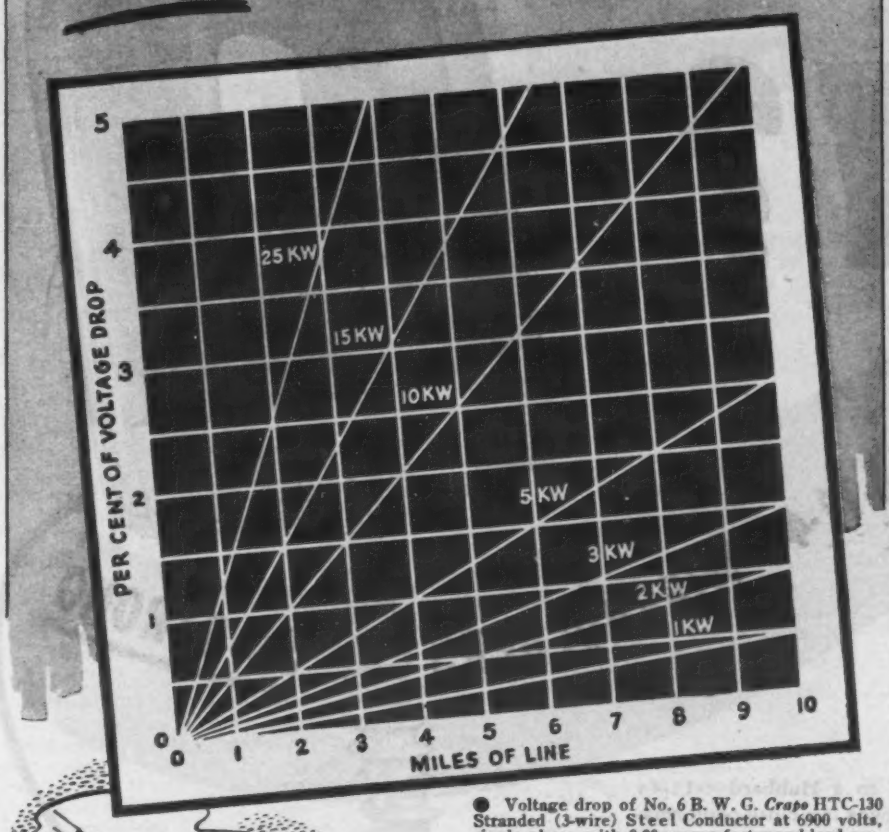

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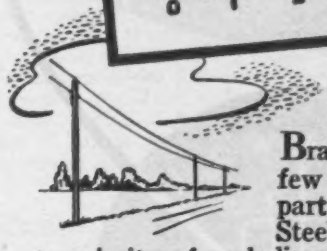

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TECHNICAL LITERATURE

Welding—Bulletin No. 113-A, Seam and Roll Spot Welding Machines contains a section on principles and applications of electric seam welding and tooling data. Also included are tables listing information on gauges, cyclage timing, pressures, current, welds per inch and speed of material per minute for low carbon steel, aluminium and stainless steels. Copies may be secured from Sciaky Bros., 4915 W. 67th St., Chicago, Ill.

Cathode Ray Tubes—A 16-page illustrated booklet entitled "How and Why Cathode Ray Tubes Work" including a discussion of complete television set-ups may be obtained from North American Phillips Co., Inc., 100 E. 42nd St., New York, N. Y. Subjects and material covered in the four sections are history, mathematical concepts, present-day problems, manufacturing problems, tube testing and tube designs.

Chlorowax—Technical bulletin gives information on the material with specific tables and data on properties. Tables listing physical properties, chemical properties, solubility and compatability with plastics are included. Discussion on flame resistant coatings and preparation of an emulsion are also included. Copies may be secured by writing to Diamond Alkali Co., Pittsburgh 22, Pa.

Permanent Magnets—Circular C 441 prepared by Raymond L. Sanford of the National Bureau of Standards lists a summary of the technical data available and a brief discussion of the design and testing of permanent magnets. Copies are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C. at a price of 10 cents.

Air Disinfection—Folder 800-45 is a 4-page folder on the subject of Air Disinfection by lights which is obtainable from Edwin F. Guth Co., 2615 Washington Ave., St. Louis 3, Mo. It contains answers to such questions as: what are the lights, what do they do, and what can be expected of them. It also contains layout data and instructions.

Fluid Flow Measurement—Publication R-100A containing information necessary and helpful in selecting a Rotameter for any particular service has been issued by the Cochrane Corp., 17th St. & Allegheny Ave., Philadelphia 32, Pa. It contains specific gravities of gases and of the various metals used in floats, together with formulas for converting water and air capacities to terms of other liquids and gases. Other selection factors, such as pressure drop, length of scale and float materials are also noted.

Blowers—Principle of operation, design and construction of rotary positive displacement type blowers and exhausters is described and pictured in a 16-page bulletin (No. P 100) which is available from the Pottstown Blower Co., Division of Allen Billmyre Co., 431 Fayette Ave., Mamaroneck, N. Y. Also contains tables of capacities of both blowers and exhausters, and the technical data necessary in selecting a unit for a specific application.

Varnishes—Booklet entitled "DC Varnishes" describes the properties of Silicone Varnishes and outlines the recommended practice in applying this type of varnish to the insulation of electrical equipment. Describes its use as a complement to such material as Fiberglas, asbestos and mica in the design of new equipment and in rewinding of old equipment. Copies may be obtained by writing Mr. O. D. Blessing, Sales Manager, Dow Corning Corp., P. O. Box 592, Midland, Mich.

70/30 for CO_2 and O

A hard-temper, phosphorized deoxidized copper tube that failed in a vent condenser installation was submitted to Scovill for examination.

Localized corrosion was found on the outside surface adjacent to the tube sheet where perforation of the tube wall occurred. The remainder of the tube showed no thinning of either the inside or outside and measurements proved the tube still retained its original gauge.

SERVICE CONDITIONS INDICATE WRONG ALLOY

Further investigation developed that the condensate on the outside of the tube contained relatively high amounts of carbon dioxide and oxygen and that there was mild erosion of the tube surface near the tube sheet where maximum flow of the condensate occurs.

Copper is not recommended where erosion may be a factor, so this customer's problem was solved when Scovill recommended 70/30 Cupro-Nickel tubes. In less severe service conditions, an inhibited Admiralty Metal such as Phosphorized Admiralty would resist this type of corrosion better than the copper tubes originally installed.

SCOVILL SERVES THREE WAYS

This case illustrated two of Scovill's three services.

Service in Men provides specialized consultation on tube problems and installation methods. This ties in, as in this case, with *Service in Metals* which covers selection of alloys and study of specific problems in field and laboratory. *Service in Manuals* offers literature on condenser and heat exchanger tubes.

For your copy of the booklet *Scovill Condenser Tubes*, address Scovill Manufacturing Company, 24 Mill Street, Waterbury 91, Connecticut.

Scovill
MANUFACTURING COMPANY
WATERBURY 91, CONN.

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ONE PRODUCT . . . THREE SERVICES
Service in Manuals . . . Service in Metals . . . Service in Men

NEWS ABOUT PEOPLE

G. H. Blake New President of N. J. Public Service

George H. Blake, who was elected president of the Public Service Corp. of New Jersey and subsidiary companies, to succeed Edmund W. Wakelee, retired, (ELECTRICAL WORLD, April 21, page 10) started with the company in 1910 as a trial attorney in Jersey City. In 1921 he was promoted to assistant general solicitor and in 1923 to general solicitor. He was made a director of the corporation in 1934 and a member of the executive committee of the board of directors a year later. Mr. Blake was promoted to vice-president and general solicitor in 1937 and to executive vice-president in 1943. A graduate of New York University, he was admitted to

G. H. Blake

the bar in 1908 and practiced law with Edwards and Smith in Jersey City prior to joining Public Service.

Mr. Wakelee had a long, active and varied experience in the business, legal and civic life of New Jersey. For more than two score years he was identified, in an official capacity, with New Jersey public utilities; for more than a quarter of a century he was an officer of Public Service. An eminent lawyer, Mr. Wakelee was a member of the New Jersey and New York bars. His identification with the utilities in New Jersey dates from 1900 when he became counsel for the New Jersey & Hudson River Railway & Ferry Co. When this company was leased to Public Service Railway Co. in 1911, Mr. Wakelee was retained

E. W. Wakelee

as counsel of the latter. In 1914 he was made associate general solicitor of Public Service and in 1917 he was elected a vice-president and a director of Public Service Corp. of New Jersey and subsidiary companies. He was made vice-president in charge of law in 1923, and was elected president in 1939. Mr. Wakelee is a trustee of the Edison Electric Institute and a member of the American Gas Association, and the American Transit Association.

Thomas N. McCarter, Jr., was elected executive vice-president, the position held by Mr. Blake since 1943. For the past six years Mr. McCarter has been vice-president in charge of the company's southern division. He has been a director of the subsidiary companies of Public Service since 1941 and a director of the corporation since 1943. He is a member of the executive committee of the board. Prior to joining Public Service in 1937 he was vice-president and a director of the Central New York Power Corp., the position he resigned to join Public Service. In 1937 he was made assistant vice-president in charge of the southern division and two years later was promoted to vice-president in charge of that division.

Thomas N. McCarter was reelected

T. N. McCarter, Jr.

chairman of the board and Percy S. Young, chairman of the executive committee. All other executive officers of the corporation and subsidiary companies were reelected or reappointed.

•

▶ROY KATTERHENRY, general storekeeper and purchasing agent for Indianapolis Power & Light Co., has been promoted to executive assistant, according to an announcement by H. T. Pritchard, president of the Indianapolis, Ind., utility. He succeeds to the vacancy created by the resignation of P. W. Ross in July, 1944. As executive assistant Mr. Katterhenry, in addition to retaining general supervision of the purchasing and stores department, will assist the president on special assignment and act as chairman of the company's labor committee. He will also assist the first vice-president. Mr. Katterhenry has been associated with Indianapolis Power & Light Co. for more than 28 years.

▶ALBERT T. O'NEILL has been appointed chief counsel for the Buffalo, Niagara & Eastern Power Corp. and its western New York subsidiaries. Assistant counsel since 1934, he is succeeding the late Warren Tubbs. Mr. O'Neill has been identified with the electric utility business for 36 years and for the past 15 has been with Buffalo Niagara & Eastern Power Corp. and its affiliated companies. Some few years ago he was president of the Bradford Electric Co., Bradford, Pa.

▶J. H. MCLAUGHLIN, formerly chief electrical engineer for the Vancouver Housing Authority, has been named general superintendent of the Electrical Construction Co., Portland, Ore. Mr. McLaughlin has been engaged in industrial electrical construction in the

Illustrated is a DILECTO fabric base laminated phenolic part used in airborne electrical equipment. Since this part is subject to severe mechanical stresses and is also an insulator it must be strong and remain stable under vibration, high humidity and temperature extremes. DILECTO meets all these requirements, with a wide margin of safety.

KL-45

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CELORON—A Molded Phenolic.
DILECTENE—A Pure Resin Plastic Especially Suited to U-H-F Insulation.
HAVEG—Plastic Chemical Equipment, Pipe, Valves and Fittings.

The NON-Metallics

DIAMOND Vulcanized FIBRE
VULCOID—Resin Impregnated Vulcanized Fibre.
MICABOND—Built-Up Mica Electrical Insulation.

Standard and Special Forms

Available in Standard Sheets, Rods and Tubes; and Parts Fabricated, Formed or Molded to Specifications.

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Bulletin GF gives Comprehensive Data on all C-D Products. Individual Catalogs are also Available.

C-D Dielectric materials are engineered to meet specific electrical and mechanical problems. There are standard grades developed as a result of experience gained during 50 years of serving manufacturers in every industry. These standard grades can, however, be modified to meet particular problems. Combinations of the different C-D NON-metallic materials can also be made to provide required combinations of properties. C-D technicians will be glad to study your "What Material" problems and suggest solutions.

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Insulation Resistance Tester.

Sturdy construction throughout. Vibrators seldom if ever replaced. Power from 2 No. 6 dry cells producing constant potential of 500 V. Range 0-200 megohms, 2000 ohms, 150-300-600 V., AC or DC. One of 36 models.

Model 255

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For determining resistance of ground connections.

4 ranges for extremes of dryness and moisture. Ranges 0-3, 0-30, 0-300, 0-3000 ohms. Model 251 has triple range for average ground conditions. Design efficiently excludes "strays". Controlled sensitivity. Rugged Reliability. Utmost accuracy.

Send for bulletins. Also HYPOT, insulation breakdown tester. VOLTAMMETER for measuring AC voltage and amperage, etc. We recalibrate and repair instruments, any make. Engineering Service Representatives in All Principal cities.

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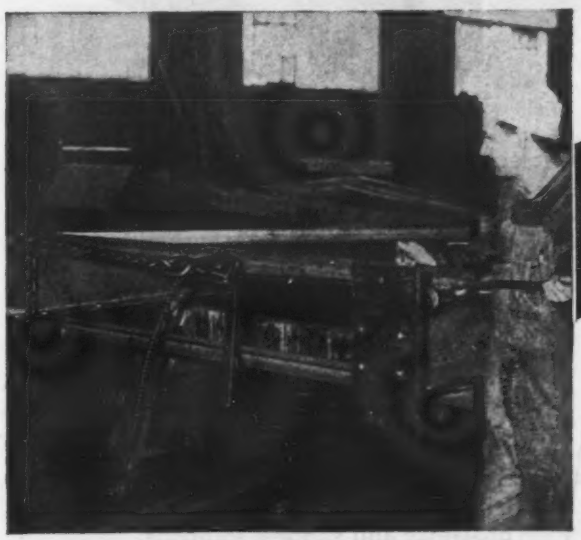


A HOIST TO FIT THE JOB

Coffing "Safety-Pull" ratchet lever hoist pulling I beams together for lining up holes to bolt bracing cross member in place.

To do the toughest jobs in a structural steel plant and do it quickly and safely a hoist or "puller" must be able to take brutal punishment hour after hour and for economy must give uninterrupted service month after month.

That is the job for a Coffing "Safety-Pull" ratchet lever hoist. The dual purpose hoist or puller with safety valve handle.

Write for Catalog No. EG-6

COFFING HOIST COMPANY

RATCHET LEVER HOISTS - SPUR GEAR HOISTS - ELECTRIC HOISTS
LOAD BINDERS - DIFFERENTIAL HOISTS - TROLLEYS

DANVILLE, ILLINOIS

Portland area for the past 30 years. After leaving the Vancouver Housing Authority, he operated his own business, the J. H. McLaughlin Electrical Co., for some time.

•

Howell Electric Names Keely Sales Manager

Announcement has been made of the appointment of Leroy F. Keely to the position of general sales manager of the Howell Electric Motors Co., Howell, Mich.

Mr. Keely has spent more than 20 years in the development, sales and

application of electric motors. His past duties have taken him into the principal industries using electric motors in all sections of the country. He is a graduate of the electrical engineering school of Michigan State College. Subsequently at the Mellon Institute he did special research and development work on insulation problems as applied to electric motors.

•

▶ Dr. A. Pen-Tung Sah, president of the National University of Amoy, China, is acting as visiting professor of electrical engineering at Stanford University where he is teaching a class in alternating current machinery to soldier-students enrolled in the Army Specialized Training program. One of six Chinese educators invited by the Department of State to visit America as part of a cultural cooperation program, Dr. Sah is a graduate of Stanford and received the Doctor of Science degree from Worcester Polytechnic Institute in Massachusetts.

▶ Ralph E. Sorenson, manager of the small appliance division, Westinghouse Electric & Manufacturing Co., Mansfield, Ohio, has been elected chairman of the Office of Price Administration's

STRENGTH with STAMINA

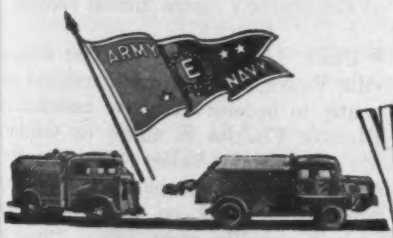
STURDY CONSTRUCTION OF YORK-HOOVER BODIES PASSES SEVERE WAR-TIME OPERATIONS TEST

"Strength With Stamina" through "all metal" construction and reduced body-weight are basic characteristics of York-Hoover Public Utility Bodies.

Designed for the job and built to "take it", they pass the severe test of war-time operations on both the home and war fronts.

Whether it be a small service unit for emergency repair, a ladder job for overhead work or a heavy duty line construction body with complete equipment, it will pay you to get the full York-Hoover story before a decision is made.

Be "Body-Wise"! Consult York-Hoover about your body replacement plans.



YORK-HOOVER CORPORATION

BODY DIVISION **YORK, PENNSYLVANIA**

INSTRUMENT MOUNTING STRUCTURES

Experience — in engineering, in design, in fabricating is assurance of a quality product. For 62 years, Littleford has fabricated Cabinets, Panels, Enclosures, Control Desks and Cases; and this experience in fabricating is apparent in the finished unit. For your next mounting structures, send blueprints to Littleford.

LITTLEFORD

LITTLEFORD BROS., INC.
421 E. Pearl St. Cincinnati 2, Ohio

small electrical appliance manufacturers' industry advisory committee at its organizational meeting held recently in Washington, D. C.

•

New Assignments Made by General Electric

J. E. N. Hume, commercial vice-president and manager of the industrial divisions and J. W. Belanger, manager of the federal and marine divisions, General Electric Co., have been named assistant managers of the sales apparatus department, C. H. Lang, vice-president and manager of apparatus sales has announced. Karl H. Runkle has been named to succeed Mr. Hume as industrial division manager and R. S. Neblett to succeed Mr. Belanger. Simultaneously Mr. Lang announced the appointment of W. V. O'Brien as manager of the central station divisions, succeeding H. V. Erben, who some time ago was named assistant general manager of the apparatus department.

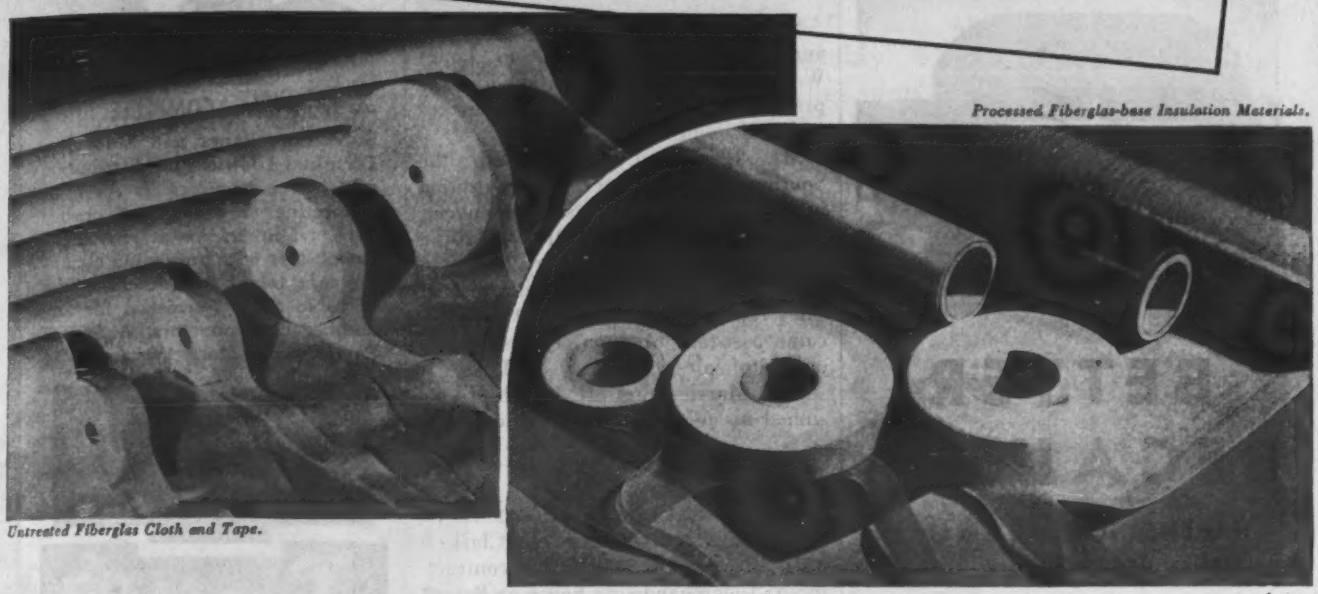
Mr. Hume has been manager of the industrial divisions since 1935. He entered the employ of General Electric in 1907 and was named a commercial vice-president in 1938. Mr. Belanger has been manager of the federal and marine divisions since 1943. A graduate of Iowa State College, Mr. Runkle has been with General Electric since 1917. For the past nine years he has been an assistant manager of the industrial divisions. Mr. Neblett joined General Electric in 1923. He has been assistant manager of the turbine division since 1939 and since 1943 has served as assistant manager of the federal and marine divisions. Following graduation from the Virginia Military Institute, Mr. O'Brien joined G. E. in 1922. He has been assistant manager of the central station divisions since January of this year.

•

► Dr. Robert A. Millikan, executive head of the California Institute of Technology, was given the Arthur Noble award for outstanding citizenship in 1944 at the Pasadena, Calif., Chamber of Commerce's recent annual banquet.

► Ulric J. Gendron, assistant Bonneville Power Administrator, resigned recently to become executive assistant to Director Charles E. Carey on California's Central Valley Project. Mr. Gendron, who fills a position created by pressure of work on CVP, had been with Bonneville since 1937. Appointment of D. L. Marlett as assistant administrator to succeed Mr. Gendron, following his transfer to the Central Valley Project in California, has been

WHY DO PROCESSORS MAKE *so many kinds* OF FIBERGLAS* INSULATION MATERIALS?



Processed Fiberglas-base Insulation Materials.

Untreated Fiberglas Cloth and Tape.

Designers and manufacturers of innumerable types of electrical equipment recognized the unexcelled advantages which Fiberglas offers as a base for insulation materials. Fiberglas—glass in fiber form, woven into textiles—provides a thin, strong, flexible base for insulating impregnants.

Many electrical engineers saw ways in which Fiberglas insulation materials could solve problems which no other insulation material could solve. Manufacturers recognized it as a means of providing an additional safety factor for their products.

To meet these specifications and the demand for better insulation materials, processors and insulation manufacturers developed a wide range of Fiberglas-base materials. So that, today, there is a Fiberglas Electrical Insulation Material available to meet virtually every insulation need such as:

Fiberglas-insulated Wire and Cable ... Most wire manufacturers are currently manufacturing Fiberglas-insulated wire of many different types for a wide range of applications—magnet wire, single and double covered; lead wire; radio hook-up wire; aircraft ignition cable; neon sign cable; thermocouple wire; communication cables; and wires for special purposes.

Fiberglas Varnished Cloth and Tape ... Made by many manufacturers who impregnate various types of Fiberglas Cloth, in several thicknesses, with several kinds of varnishes specially developed to meet normal or extreme conditions. These products are available in 36" widths or cut to any desired tape width.

Fiberglas-Mica Combinations... The combination of thin, strong glass cloths with mica for ground insulation is not dependent upon impregnating varnish for its electrical characteristics. The mica splittings provide dielectric strength while Fiberglas gives it a tough, stable inorganic backing.

Fiberglas Laminates ... Most manufacturers of electrical laminates make one or more types of Fiberglas-base materials, which are used for panels; in motors and generators as slot sticks; armature or stator end punchings; brush holders; space blocks, etc. Also, Fiberglas-base laminates, having low electrical losses at high frequencies and high humidity, are finding increasingly wide use in radio, radar and other electronic applications.

Write for booklet ... EL 44-7, tells what type to use, where and how. Send for your copy today, ask for the name of the Fiberglas Electrical Insulation Materials supplier located nearest to you. *Owens-Corning Fiberglas Corporation, 1858 Nicholas Building, Toledo 1, Ohio.*

In Canada, Fiberglas Canada Ltd., Oshawa, Ontario.

Each Distributor of Fiberglas-base Insulation Materials has his own source of supply; none of these processed insulations is made by Owens-Corning Fiberglas Corporation

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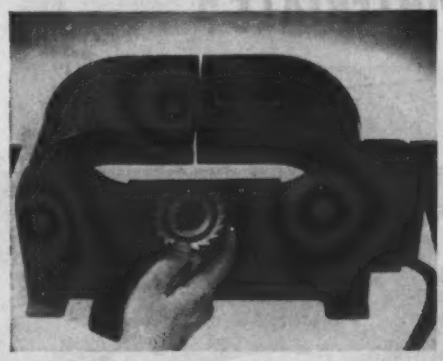
ELECTRICAL INSULATION MATERIALS

JAY "ONE-PASS" DE MAGNETIZER



BETTER BECAUSE—

—It is ENGINEERED . . . a strictly quality product.

—It has POWER . . . One Pass demagnetizes COMPLETELY.

—PLATE CONTACT under hand is convenient and sure . . . saves current. Foot contact optional at slight extra cost.

—Available for 110 or 220 volts.

—One model accommodates most tools. Other sizes built to order.

PRICE **$87.00** f.o.b. Detroit

Shipping Weight, 40 pounds

Chips do not adhere to demagnetized tools. Result, longer tool life; lower cost; more accurate work; less scrap. Literature on request.

JAY ELECTRIC CO.

5664 St. Jean

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approved by Secretary of the Interior Harold L. Ickes. Mr. Marlett joined the Bonneville staff in 1939 and served as executive assistant to Administrator Paul J. Raver until 1943, when he was appointed controller of the administration.

•

J. W. Blatchford Assigned New Executive Duties

Southern Wood Preserving Co. has announced the appointment of James W. Blatchford to the position of vice-president and eastern sales manager with offices in Philadelphia.

Mr. Blatchford started with the Southern Wood Preserving organization in 1920 as a wood block superintendent, going around the country installing creosoted wood block factory floors. In 1924 he was made Philadelphia district sales representative and in 1935 he became assistant to the vice-president in charge of sales, the late S. D. Hicks. It was on March 1 that Mr. Blatchford assumed his new executive position.

•

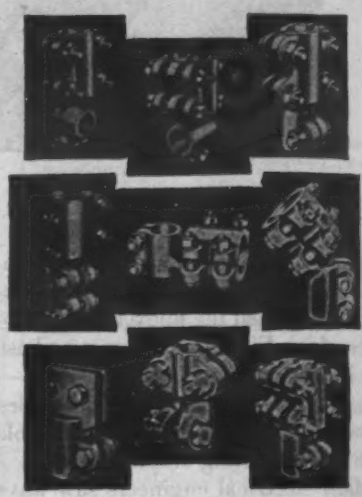
▶ WILLIAM E. CLARK and CHARLES W. MILLS have retired from the Clark & Mills Electric Co., 50-year old contracting and merchandising house at Boston and Cambridge, Mass. HAZEN D. BLAKENEY, formerly superintendent, has become president, and ELTON W. WILLIS, for the past 21 years sales engineer with the J. J. Costello Co., Boston, has been elected vice-president. Mr. Willis is a graduate of the Massachusetts Institute of Technology, and after a short period with General Electric at Schenectady, joined the Costello company, which represents in New England among others the I-T-E Circuit Breaker, Joslyn and Burndy Engineering companies. HAROLD J. RANDOLPH, for the past five years field engineer in New England for Schweitzer & Conrad, Inc., has succeeded Mr. Willis at the Costello company.

▶ ROY W. JOHNSON, general sales manager of the Warren Telechron Co., Ashland, Mass., has been elected vice-president and a director of the company. Prior to joining the Warren Telechron Co. last May, Mr. Johnson served for a year and a half as director of the Facilities Bureau of the War Production Board. For a number of years he was associated with the General Electric Co. and Schick, Inc., in merchandising capacities.

▶ GEORGE C. STODDARD, formerly vice-president, has been elected president and treasurer of the De Laval Separator Co.

—from the COMPLETE line"

Stud Connectors and Solderless Terminal Adapters for distribution and power transformers . . . for connecting to cable, pipe or bus bar . . . in line or at any angle. Connectors with reversible clamping caps take two different ranges of cable sizes. Furnished for any number of conductors. A few of Penn-Union's many types:



Also . . . the most complete line of Service Connectors, Cable Taps, Tees . . . Straight and Parallel Connectors . . . Bus Supports, Spacers . . . Grounding Clamps, Terminal Lugs, etc. etc.

Penn-Union conductor fittings are the first choice of leading utilities, industrials, electrical manufacturers and contractors—because they have found that *"Penn-Union" on a fitting is their best guarantee of Dependability.* Write for Catalog.

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ERIE, PA. *Sold by Leading Jobbers*

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Conductor Fittings

BEARING COSTS TOO HIGH?

Simplify the Loads with

ROLLWAY

RIGHT-ANGLE LOADING

Yes, simplify the load and simplify the design . . . and get longer bearing life. It is easy with Rollway Bearings because Rollway Right-Angle Loading not only gives you the higher capacity of solid cylindrical rollers, it reduces the unit loads. That's because Right-Angle Loading splits compound loads into the two simple components of *pure radial* and *pure thrust*—each carried on a separate bearing assembly. Thrust cannot pile up on radial bearings, and vice versa. There are no oblique loads, no resultants—just simple forces acting at right angles to the roller axes. Factors of safety can be lower . . . housings simpler and more compact. Maintenance work and down-time for maintenance are both reduced.

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Let our engineering specialists analyze your problem and recommend the types and series best suited to your need. No charge or obligation. Just send a drawing or detailed design. S.A.E. or American Standard metric dimensions and tolerances are available for most applications, assuring quick supply and low cost.

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For testing—
Instruments—
Meters & Relays—
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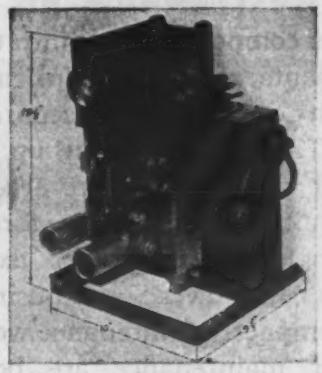
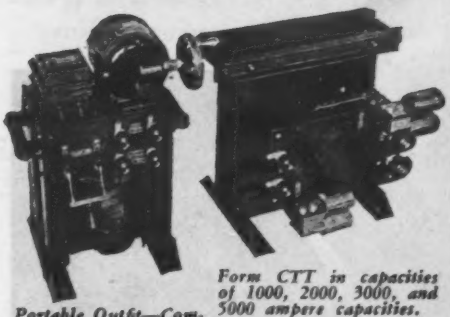


Type M, 300 and 800 ampere capacity

These Loads are designed to provide a source of heavy current with minimum weight. See Cat. 1 Sec. 1 for full details.

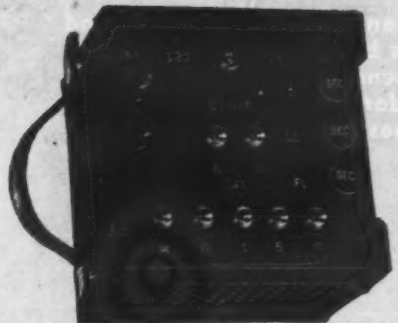
STATES TESTING EQUIPMENT



Portable Outfit—Compact—very Convenient.

Form CTT in capacities of 1000, 2000, 3000, and 5000 ampere capacities.

One unit includes the Loading Transformer and the second unit consists of Auto-wound Transformer, control switches, and Regulator.



Type 1 Load, Cat. No. 11569, capacity 15 ampere, 120-240 volts.

Here is a positive way to test 50% power factor of 5, 10, 15 ampere watthour meters.

Tear off and mail today to
THE STATES COMPANY
3 New Park Ave., Hartford, Conn.

Please send me information on Loading Transformers. I am interested in testing.....

Name ..... Title .....

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OBITUARY

Eben G. Crawford

Eben G. Crawford, president of the Cleveland Electric Illuminating Co., whose death was announced in ELECTRICAL WORLD, April 21, page 6, became affiliated with the Cleveland utility in 1921 in the capacity of secretary to handle financing. At that time the utility was initiating a period of broad expansion to meet increasing demands for electric light and power service. On Mr. Crawford's fiftieth birthday, September 6, 1933, he was elected president, a director and a member of the executive committee of the Illuminating Company, succeeding Robert Lindsay, who had been an officer for 40 years.

1933

When Mr. Crawford took office as president, Cleveland along with the rest of the country was still in the depths of the depression of the 1930's. He exercised his ability and influence to help bring about recovery, and in many ways contributed to the restoration of sound basic conditions in banking and other fields. In 1938 he launched a $35,000,000 construction program which put the company in a position to supply plenty of power on time to meet the enormous increases in demand created by the vast expansion of industry for war production. He was among the first to become interested in post-war planning, extended his co-operation to various organizations active in this field and intensified the industrial development work of the Illuminating company to help create high levels of business and employment.

Mr. Crawford was born in Franklin, Pa., and attended Dartmouth College and Columbia University.

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► WARREN R. HILL, electrical engineer in charge of maintenance at the Aluminum Co. of America's plant in Edgewater, died in Englewood Hospital on April 11 at the age of 50. A graduate of Worcester Polytechnic Institute, he was an engineer with the Consolidated Edison Co. of New York for 20 years before joining Alcoa in 1941.

•

Sir Ambrose Fleming

Sir Ambrose Fleming, one of Britain's outstanding electrical engineers, inventors and scientists, died on April 19 at Sidmouth in Devon at the age of 95. Sir Ambrose was the inventor of the famous "Fleming valve," commonly known as the radio tube. This was in 1904, but even before that time he was closely associated in work on the wireless with Marconi. Throughout his life he made outstanding contributions to the development of electric lighting, the telegraph and the telephone.

Sir Ambrose was born in Lancaster and was educated at University College in London and St. John's College in Cambridge. He was a professor of electrical engineering at University College from 1885 to 1926 and an adviser to the Edison Electric Light Co. in England from 1882 to 1894.

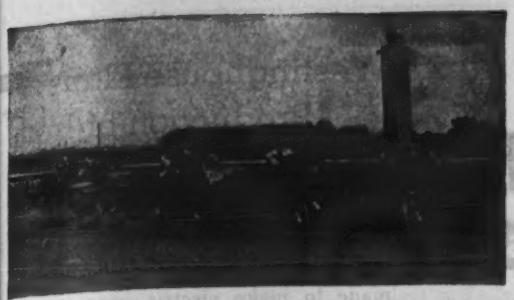
He received many honors for his achievements. The British Institute of Electrical Engineers gave him its Faraday Medal in 1928. The Franklin Institute, in Philadelphia, awarded to him the Franklin medal in 1935. He also held the Kelvin medal, the gold medal of the American Institute of Radio Engineers, and many other awards.

•

► ALONZO C. BELL, an electrical engineer and president of Powers & Robinson Foundry & Machine Co., Garwood, N. J., died on April 10 of a heart attack at his winter home in Miami, Fla. He was 68 years of age. Born in Washington, D. C., Mr. Bell was graduated from Cooper Union Institute in New York and going to Westfield in 1907, with his brother, the late Thaddeus R. Bell, he started electric motor production. He became president of the Bell Electric Motor Co. in Garwood and at the time of his death was serving as president of Powers & Robinson. Mr. Bell was a member for life of the American Institute of Electrical Engineers.

► HERBERT J. BROWN, 83, president of the Brown Co., Berlin, N. H., and Portland, Me., for 30 years prior to his retirement in 1935, died at Falmouth, Me., on April 16. He was a native of Portland, and prominent in civic and philanthropic interests.

► LOUIS SCHULTZ, president and founder of The Sunlite Mfg. Company, Milwaukee, Wis., died on March 16.



AWAY AHEAD!

Tobe Leads the Noise Elimination Field

FEW problems are as vexing as the elimination of unwanted radio interference set up by the operation of nearby electric motors. And few sources of engineering advice on this subject are as experienced as the Tobe Engineering Staff. *Tobe is the acknowledged leader in this field;* our organization has devoted 17 years to the intricate problems of noise elimination.

The large #1182 Navy-Type Filter illustrated above is an example of our specialization. Examine the curve and container dimensions. This is only one of a large number of filters designed to meet special needs. Send for complete details. Let us help you solve any problem connected with blotting out unwanted "man-made" radio static. Your inquiries are welcome.

TOBE DEUTSCHMANN CORP., CANTON, MASS.

GRAND CENTRAL TERMINAL BUILDING
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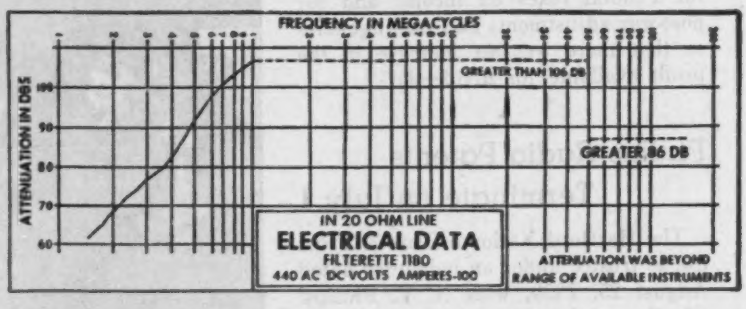


SUPPRESS MAN-MADE RADIO STATIC
TOBE
FILTERIZED

TYPE 1182—ATTENUATION RANGE
150 KC to 150 MC

CONTAINER DIMENSIONS

Length . 22 1/8" Height . . 41/8"
Width . . 11 7/8"

This unit contains three #1180 Filterettes, each bearing Navy-Type No. CTD 53177.

MANUFACTURING MARKETS

G.E. Net Profit Rises 13 Percent in '45

General Electric Co. profit available for dividends for the first three months this year amounted to $11,762,662, or 41 cents a share of common stock, President Charles E. Wilson announced at the annual meeting of the company's stockholders. This represented an increase of 13 percent over the $10,384,405, or 36 cents a share, earned during the corresponding quarter of last year.

Net sales billed, representing shipments, during the first quarter of this year totalled $309,766,472 compared with $354,624,206 in the same period a year ago, a decrease of 13 percent. Mr. Wilson explained that the reduction in billing resulted from lower prices on war products and from decreased output in one operating department where it was necessary to make a complete changeover in order to manufacture a different type of product required by the Armed Services. "Due largely to these factors and to the fact that costs and expenses did not decrease proportionately," he said, "the company's total income was 37 percent less than in the first quarter of last year. However, this decrease was more than offset by a 46 percent reduction in the amount set aside as provision for Federal taxes on income and for post-war adjustments and contingencies so that there was an increase in the profit available for dividends."

•

Philips Radio Patents Terminate on July 1

The Hartford National Bank & Trust Co. as trustee under an indenture dated August 25, 1939, with N. V. Philips' Gloeilampenfabrieken (Philips Incandescent Lamp Works Company) of Eindhoven, Holland, has announced that on July 1, 1945, all licenses issued by the Radio Corp. of America under the United States patents of Philips will terminate.

These patent rights have flowed to American industry for the last twenty years through license agreements (now terminated) with RCA, General Electric Co. and Westinghouse Electric & Manufacturing Co.

The Trustee is taking steps to make the patent rights available to the Government and industry under appropriate terms after the present licenses expire. RCA, General Electric and Westinghouse will continue to hold non-exclusive licenses after July 1 under existing patents.

•

Booklet Advises Foremen on Mental Ills of Veteran

A booklet to aid foremen who have returning servicemen under their supervision has been prepared by the Allis-Chalmers Manufacturing Co. Entitled "You and the Returning Veteran," the booklet was prepared with the assistance of the Wisconsin Society for Mental Hygiene and gives extensive information on handling veterans who must overcome mental difficulties in adjusting themselves to civilian life.

NEW RUBBER PLASTIC—Articles made of Styraloy, a compound of styrene and butadiene, are shown by Donald L. Gibb, manager of Dow Chemical Co.'s Plastics Engineering Division. Styraloy's electric properties place it in the field of low loss, low capacitance, high dielectric strength insulating materials. It can also be used for conduit pipe

Westinghouse Plans Production of Irons

Westinghouse Electric & Manufacturing Co. has announced that electric irons will probably be the first home appliances to go into production after victory in Europe. Plans have been made to make electric irons as soon as materials are available and no reconversion problems are involved, the company stated.

Production of other small appliances will be begun within four to six months after the end of the European war, depending on availability of manpower and materials, the company predicted. As far as electric ranges, refrigerators and other large appliances for which there is a large potential demand, Westinghouse estimated that it will require eight to nine months after materials are released before production can be initiated.

•

Electric Appliances Can Be Included in Mortgage

New electric appliances, such as ranges or refrigerators, will be considered as part of the real estate security for loans subject to the stipulation that some degree of affixation of the article to the real estate will be required.

This announcement was made by L. Douglas Meredith, vice-president of the National Life Insurance Co., Montpelier, Vt., who said that the company's new loan, or so-called "packaged mortgage," will make it easier for persons to acquire a completely equipped house.

•

Tungsten to Stay Scarce

The shortage of tungsten is expected to continue after V-E day, members of the Incandescent and Fluorescent Lamp Industry Advisory Committee have been told by War Production Board officials. It is expected that this element will continue to be the principal limiting factor in production of incandescent and fluorescent lamps, WPB said. Even though particular limitation orders might be revoked after V-E Day, there will be preference rating bands for military and essential civilian orders.

•

Triples New Business

Foster Wheeler Corp. booked more than three times as much new business in the first quarter, with March estimated, as it did in the corresponding period of 1944, J. J. Brown, chairman, stated at the recent annual stockholders meeting.

Gates — Intake, Sluiceway and Spillway

Hydraulic Turbines — Francis and Propeller Types

Rack Rakes • Trash Racks

Valves — Pipe Line and Penstock

★

NEWPORT NEWS SHIPBUILDING AND DRY DOCK COMPANY

NEWPORT NEWS, VIRGINIA

Manufacturers Issue Earnings Reports

Among the electrical manufacturing companies that have recently issued earnings reports covering 1944 operations are the following:

ANACONDA WIRE & CABLE—Net profit, $1,225,282, after a provision of $300,000 for contingencies, and $3,840,000 for federal taxes, equal to $2.90 a share, compared with $1,319,698, or $3.13 a share in 1943, after taxes of $2,580,000, and a deduction of $300,000 for contingencies. Renegotiation of war contracts for 1941, 1942, and 1943 was concluded during 1944.

CENTURY ELECTRIC—Net sales, after allowing for renegotiation, $16,568,273, and net profit, $573,723, equal to $1.19 a share, compared with net sales of $15,304,840, and net profit of $493,920, after renegotiation, or $1.09 a share in 1943.

WESTON ELECTRICAL INSTRUMENT—Including subsidiary, net profit, $510,890, equal to $3.18 a share, compared with $564,556, or $3.52 a share in 1943.

FOSTORIA PRESSED STEEL—Net income $28,807, or $2.06 a share, including postwar refund, compared with $30,325, or $2.18 a share for 1943.

COPPERWELD STEEL—Sales, $35,396,142, largest in the history of the company and comparing with $33,622,430 in 1943. Net income, $924,707 after provision for federal and state income taxes and inclusion of $59,993 recoverable from taxes of a prior period because of carry-back of unused tax credit. This compares with net income of $1,052,297 in 1943 after provision for federal and state income taxes and inclusion of $182,802 recoverable that year because of tax carry-back. After allowance for dividends on preferred, net income was equal to $1.50 a share before tax carry-back and to $1.62 a share after tax carry-back on 514,864 outstanding shares of common stock. This compares with $1.50 and $1.85 respectively in 1943.

•

Canada May Place Quota on Pole Shipments to U. S.

The possibility that shipment of poles from Canada to the United States may be restricted was revealed this week by the Office of the Timber Controller at Ottawa. Poles are at present about the only forest product being exported without being under some quota system. Some Canadian companies are shipping their entire production to this country; so restrictions may be placed so that Canadian users will be able to get essential supplies.

•

Post-War Battery Ready

A 22½ volt battery smaller than a pack of cigarettes and known as the 412 "Eveready" Mini-Max "B" battery will be placed on the market after the war by the National Carbon Co. The battery will be used in electronic fields.

Field Reports on Business

Manufacturers have booked a large number of Navy contracts for electric apparatus and control equipment. Despite cut-backs the demand for lighting supplies, wiring devices and special electrical materials continues fairly strong. There is active bidding on capacitors, resistors and insulating materials.

NEW ENGLAND

High Standard Mfg. Co., New Haven, has been awarded a DFC contract amounting to $450,000 for the purchase of equipment to be used in its Hamden plant. Casco Products Corp. Bridgeport, Conn., resumed the manufacture of heating pads by authorization of the WPB. Connecticut companies have booked a large number of Navy contracts for electrical apparatus and control equipment.

Despite cut-backs in contracts which in some industrial areas have slowed down activity, the demand for lighting supplies, wiring devices, panelboard materials, and special electrical materials essential to the Navy continues fairly strong. Marlin Firearms Co., New Haven, has been authorized to manufacture 10,200,000 cartridge links. Other awards received by New Haven plants include generator test apparatus $98,956, United Advertising Co.; conduit assemblies, Bolton Mfg. Co., and oil cooling apparatus, S & O Mfg. Co. Lewis Engineering Co., Naugatuck, Conn., has been awarded contracts for lead assemblies.

Massachusetts companies were active bidders on capacitors, resistors, and insulating materials. A number of sizable construction contracts remain on the Navy Public Works schedule among which are noted a 600 unit housing project in Rhode Island, installation of training devices, New London (Conn.) Submarine Base, and additional facilities at navy yards involving contracts for wiring for electric distribution lines.

There is some prospect that the Bethlehem Steel Corp's Hingham shipbuilding yard may be used for a temporary and emergency naval station. Officials of Sylvania Electric Products Inc. have pointed out the large volume of business that awaits manufacturers due to the need for repairs and rebuilding of radio apparatus and installations.

PACIFIC COAST

The total value of March building permits in the seven western states was $18,116,289, a 23 percent decrease from March, 1944. The Northwest held about even; Arizona, Nevada, and Utah increased, but California, which supplied 80 percent of the total volume, decreased nearly 30 percent.

Government requisitions for electrical material throughout the West continue to decrease in number and size with exceedingly keen bidding on price and delivery. Sales of marine electrical material have been lower than estimated due to unexpectedly low battle losses in the Pacific theatre of operations and continual cutbacks in shipbuilding have reduced this hitherto important factor to material needed for overhaul and refitting.

Orders include five-ton electric cranes for Pearl Harbor; Ohio Brass overhead trolley line material for San Francisco's municipal railway; a steam plant system for ASF at Salt Lake City; a $65,917 award for re-designed distributing systems in six naval auxiliary air stations in northern California and a proposed 83-mile cooperative line in the Red Lodge (Montana) region to cost $130,000. A 15-mile transmission line is to connect Mesquite, Nev., with Littlefield, Ariz.

Industrial developments with their implied electrical machinery or maintenance material include a $3,000,000 contract for 2,000 prefabricated homes to Los Angeles firms for lend-lease shipment; a plywood plant for Roseburg, Ore.; and DFC assistance, totaling $1,000,000, for Aerojet expansion at Azusa near Los Angeles.

NEW YORK

Revisions of war production schedules have resulted in substantial changes in the outlook for reconversion. Heavy cutbacks in aircraft output have already been ordered, and more are expected to be made before the end of the war in Europe.

Civil engineering construction in continental United States totaled $22,181,000 last week. This volume was 58 percent lower than in the preceding week and 57 percent below the corresponding 1944 week, according to reports to *Engineering News-Record*. Private construction was 78 percent below the high volume of the preceding week, and was 23 percent lower than a year ago. Public construction was 34 and 63 percent lower, respectively, than in the preceding week and last year. The week's volume brought 1945 construction to $488,2254,000 for the sixteen weeks, a decrease of 14 percent from the $568,425,000 reported in the corresponding 1944 period.

Retail trade in the Metropolitan area continued active, with department store sales running approximately 20 percent ahead of last year.

CHICAGO

This week brought announcement that nearly 1,000 skilled and semi-skilled employees of the huge Buick aviation engine plant outside Chicago will be released within a few days because of production cutbacks by the Army Air Forces. These layoffs, it is hoped, will ease the manpower shortage in other local war plants. Regional WMC officials estimate that 8,100 openings exist in plants here having a higher priority rating than Buick. Efforts are currently being made to transfer the Buick workers to jobs at these higher priority rated plants without loss of time.

Total employment in 50 top priority war plants in the Chicago area increased 3,700 from 118,100 on January 15 to 121,800 on March 15. At the same time employment in 630 major war and essential industries dropped 1,200 from 567,300 to 566,100.

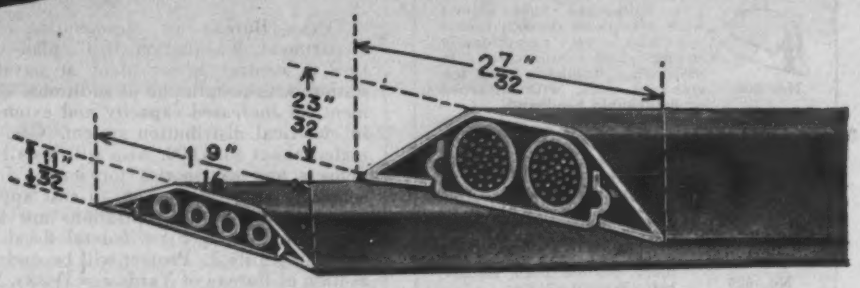
Meanwhile utility construction actually in progress in the midwest area is at a minimum. Promise of a pickup, however, is seen in the report of electrical equipment manufacturers of an upturn in inquiries from utility sources, apparently in preparation for as much summer construction as the stringent utility manpower situation and purchasing restrictions will permit at this time—which is very little. A few relatively minor construction programs have been reported. Kansas Power & Light Co., Topeka, announced an addition to its steam-electric generating station aggregating $500,000. Work will start at an early date.

Know your WIREMOLD

BUSINESS BUILDER IN TOMORROW'S MARKET FOR ADEQUATE WIRING

PANCAKE

"PANCAKE" Wiremold Overfloor Wiring Systems No. 1500, Capacity 4 No. 12; No. 2600, capacity 2 26-pair telephone cables. "Flat as a pancake; strong as a bridge."

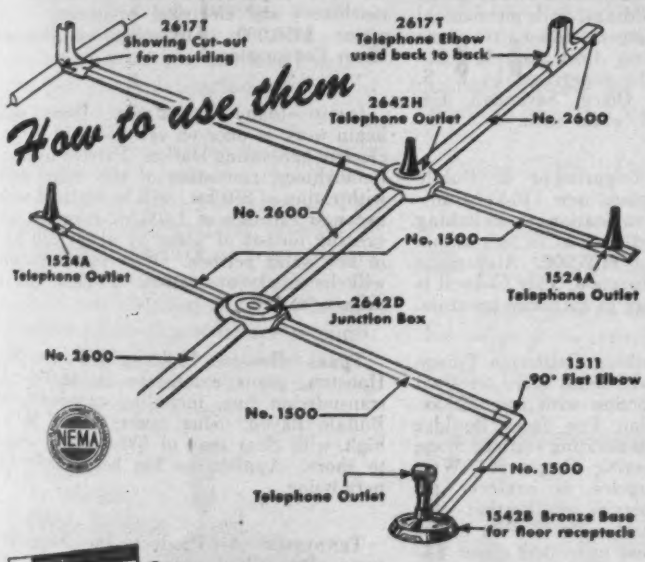


What to use

Where to use them

Wherever telephone connections or light, power, or control wiring must be run OVER THE FLOOR to desks, office equipment, benches or machines. "Pancake" is strong and trip-proof with a low ramp angle. It hugs the floor, protects the circuits, makes it possible to install, extend, or relocate wiring quickly and inexpensively.

How to use them



1524-Telephone Outlet

1524A-Telephone Outlet

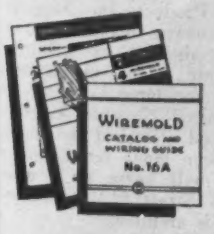
2642H Telephone Outlet

1542B-Brass Base for Floor Receptacle

1517A-Internal Elbow

2617T Telephone Elbow

Typical Installation drawing shows the use of "Pancake" raceways and fittings. Raceway base is simply cut to length and fastened to floors, with slip-joint connection to fittings at required locations. Wiring is laid in place and cover sections snapped on to complete installation. Write us for bulletins and data sheets . . . know and use this better, modern way to solve difficult wiring problems.



ELECTRICAL MAINTENANCE MEN

Wiremold Engineering Data Sheets and other literature are designed to help you solve wiring problems. If you are not receiving this literature, send us your name TODAY

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THE WIREMOLD COMPANY, HARTFORD 10, CONN.

for the safety of
YOUR WORKMEN

Use
PORTABLE
Products

"Head Protector" HATS & CAPS

No. 200

A vulcanized fibre helmet with one-piece crown. Lightweight, yet exceptionally strong and impervious to moisture. Available in ten standard sizes, with attached or detachable headband.

LINEMEN'S SAFETY STRAPS

No. 625

A lineman's belt with 4" abdominal pad of cotton webbing and a belt of diamond-stripe webbing. Metal plates provide additional reinforcement at dees. Lightweight and more flexible than leather belt. Weight, 3 lbs.

* * *

Portable Products personal protective equipment is manufactured from tested materials to assure uniform, dependable service. Write for details or phone GRant 1061.

ALSO — Complete Line of Safety Straps
Web Safety Belts • Spectacle Type Goggles
First Aid Kits • Foot Guards • Etc.

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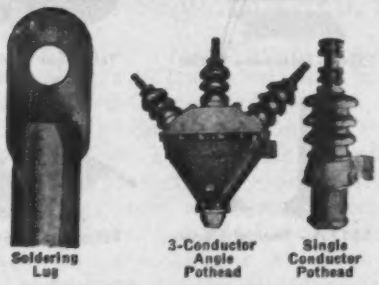
SPECIALTIES
FOR HEAVY
INDUSTRIAL SERVICE
FROM STOCK

RMC



Soldering Lug
3-Conductor Angle Pothead
Single Conductor Pothead

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ENDULATORS (POTHEADS) ALL SIZES • ALL SHAPES • ALL VOLTAGES • ALL TYPES • BUS SUPPORTS • SPLICING KITS AND MATERIALS • INSULATING COMPOUNDS

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14260 Birwood Avenue • Detroit, Mich.

Sales Opportunities

ILLINOIS—W. F. & John Barnes Co., Rockford, machine tools, parts, etc., will make extensions in plant for production of ordnance material for War Department, including additional buildings and installation of machinery and electrical equipment. Cost estimated at $6,500,000, with financing by Defense Plant Corporation. Work is scheduled to begin soon.

TEXAS—Bureau of Aeronautics, Navy Department, Washington, D. C., plans addition to central power plant at naval air station, with installation of additional equipment for increased capacity and extensions in electrical distribution system. Cost estimated about $325,000. Also will install condensers and accessories for service in assembling and repair shop, to cost approximately $30,000. Appropriations are being arranged in budget for federal fiscal year beginning July 1. Project will be under direction of Bureau of Yards and Docks, Navy Department, Washington.

NEBRASKA—Nebraska Power Co., Omaha, plans extensions in primary and secondary lines. State approval has been secured and work is scheduled to begin soon.

FLORIDA—Florida Ramie Products, Inc., 151 East 50th St., New York, N. Y., Alexander C. Kidd, president, plans new fiber processing mill, comprising several buildings, with machinery and electrical equipment for large output. A power substation is planned. Entire project will cost about $300,000. Financing has been arranged through federal aid and priority rating secured. Carlos E. Schoeppl, 3520 N. W. 46th St., Miami, is associate architect.

FLORIDA—War Department, Washington, D. C., has authorized expansion at Morrison Field, including alterations and improvements in hangars, construction of additional shops and other buildings, with mechanical and electrical equipment. Also extensions in electrical facilities. Cost about $1,100,000. Project will be supervised by U. S. District Engineers Office, Savannah, Ga. Proposed to begin work soon.

WASHINGTON — Department of Public Utilities, Tacoma, plans new 110-kv. transmission line from substation to switching station, including extensions in substation. Cost reported about $105,000. Also plans new distribution substation. City Council is considering ordinance to authorize program.

CALIFORNIA—Southern California Edison Co., Los Angeles, will build large terminal substation in connection with new 220-kv. 130-mile transmission line from Boulder Dam hydroelectric generating station. Stone & Webster Engineering Corp., 601 West Fifth St., Los Angeles, is engineer for project and will supervise construction, with engineering headquarters at 11 East Citrus Ave., Redlands. Cost estimated about $4,500,000.

NEW YORK—Bulova Watch Co., 62-10 Woodside Ave., Woodside, L. I., will carry out expansion in plant for production of fuel injection pumps for aircraft service for government, with installation of additional machinery and electrical equipment. Cost estimated about $1,000,000, with financing by Defense Plant Corporation. Work is scheduled to begin soon.

OHIO—Cleveland Electric Illuminating Co., Cleveland, plans two-story and basement addition to power substation, about 45 by 47 ft., reported to cost over $50,000. Bids for building erection will be asked soon.

PENNSYLVANIA—Bureau of Ships, Navy Department, Washington, D. C., plans rearrangement and conversion of section of navy yard, for increased facilities for ship repair service, including additional shop units with mechanical and electrical equipment. Cost estimated about $1,000,000. Appropriation is being arranged in budget for federal fiscal year beginning July 1. Bureau of Yards and Docks will be in charge, first noted address.

IOWA—Municipal Electric Department, Hawarden, has extended time for close of bids until May 10 for proposed expansion and improvements in municipal power plant, previously announced to close April 24, including installation of new diesel engine-generating unit and auxiliary equipment. Cost about $100,000. Buell & Winter Engineering Co., Insurance Exchange Bldg., Sioux City, Iowa, is consulting engineer.

NORTH DAKOTA—Otter Tail Power Co., Fergus Falls, Minn., will soon begin erection of addition to steam-electric generating station, for expansion in steam division. Installation will include new boiler unit and auxiliary equipment. Cost reported about $250,000, with equipment. Project has a priority rating.

CONNECTICUT—High Standard Mfg. Co., 1337 Dixwell Ave., Hamden, fire arms, will carry out expansion in plant for production for War Department, with installation of machinery and electrical equipment. Cost about $450,000. Financing by Defense Plant Corporation.

IDAHO—Idaho Power Co., Boise, will begin work at once on extensions in hydroelectric generating station. Present hydraulic turbines, consisting of two units, each with rating of 850 kw., will be replaced with two new turbines of 1,600-hp. capacity, advancing output of plant by about 850 kw. in low water periods. Other improvements will be made at station. Project has a priority rating.

TEXAS—Houston Lighting & Power Co., Houston, plans extensions in 66,000-volt transmission line, including crossing over Buffalo Bayou, using towers about 36 ft. high, with clear span of 400 ft., from shore to shore. Application has been made for permission.

TENNESSEE—Air Products, Inc., Manufacturers Rd., Chattanooga, manufacturer of machinery for production of industrial oxygen, nitrogen, etc., plans two one-story additions to plant for large increased capacity. Cost reported close to $500,000, with mechanical and electrical equipment. Application has been made for a priority rating and work will begin as soon as secured. Thomas G. Street, 212 South Crest Rd., Chattanooga, is architect.

Why Fargo Automatic Line Splices hold fast

REDUCE WORK HAZARD—SAVE TIME

Four-jaw serrated gripping unit holds solid and stranded wires in permanent, slip-proof grip.

The four jaws adjust better to the contour of the wire than would 3 or 2 jaws. The jaws grip from the end of the wire outward so the pulling strain is distributed along the wire — not located at one point. Because the whole jaw assembly is made from one piece of metal, the teeth automatically keep in alignment and the whole unit is stronger.

The teeth of the jaws are of uniform height and spacing which means that all the teeth bite, thereby assuring maximum conductivity as well as sure gripping. Beyond the teeth is a safety zone for accommodation of burred and upset wire ends.

The jaw is capped with a heavy copper stop plate. The conductor cannot become tangled with the spring. The spring, made of phosphor bronze for long life and high fatigue point, exerts ample pressure to prevent the conductor from working out of the jaw when the splice is not under tension. Thus, it holds fast even under alternating tension and slack occasioned by whipping wind action.

Left by itself, the splice will hold the conductor securely, but it's simple to release the wire when necessary. Pushing in on the wire forces the jaws and spring back so that a screw driver can be inserted through the "disengage" slot. This holds the spring back and the jaws open so that the wire can be withdrawn.

High conductivity—dependable service—high salvage value

The body of the Fargo splice is a heavy shell of solid copper. Conductivity of the splice is greater than an equal length of conductor, and its tensile strength is also greater.

All external and internal parts of the Fargo Line Splice are weather and corrosion resistant. The Splices can be used over and over again.

Reduce working hazards

It is obvious that the features which make this Fargo Automatic Line Splice so easy to install, with a minimum of motion and with no special tools, materially improve the safety factor when working near hot lines.

"Sag Guide" Marks Save Time

"Sag Guide" lines on each Fargo Splice show how much of the conductor should go inside.

Guide lines around the body of the Fargo Automatic Splice designate where the ends of the conductor will be after the Splice is installed and tension applied. As a result, the lineman knows in advance how much sag the line will have when the wire ends are properly inserted in the Splice. It saves time in estimating the length to which the conductor should be cut.

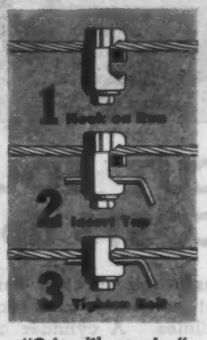
Fargo Automatic Line Splices are made to handle wire sizes from 6 Solid to 4/0 Strand. Reducing Splices, used to connect smaller wires to larger ones, are also available.

Every Fargo Automatic Line Splice is hand tested before it leaves the factory!

One-piece vise-type connectors save man hours—reduce service interruptions

Fargo solderless connectors are easy and safe to handle, permanently vibration-proof and produce high conductivity at contact point.

One-piece construction—always threaded—no time lost starting a nut—no chance of cross threading—no loose parts to lose.



"Grips like a vise"

Fargo connectors available in sizes No. 8 to 1,000,000 CM

(Approved by Underwriters Laboratories, Inc.)

Full Fargo Line Distributed by
LINE MATERIAL COMPANY
Milwaukee, Wisconsin.
(Representatives in principal cities)

For full details of complete Fargo line see listing in current Electrical Buyers Reference.

FARGO MFG. COMPANY

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SOLDERLESS CONNECTORS • LINE SPLICES ELECTRICAL SPECIALTIES

Royal-ettes

#10 in a series of informative news letters from a producer of Power Switching Equipment

ROYAL INDICATING LAMPS

TPYE ZX

There are a wide variety of Indicating Lamps available. The Royal Type ZX was built to meet the particular requirements developed by the field service experience of Commonwealth Edison Company, Chicago.

This field service experience demanded: Simplicity, Compactness, Ruggedness.

1.—Color caps have screw base for interchangeability

2.—Standard telephone bulb is used

3.—Receptacle body is used on metal, slate, or ebony asbestos panels

The Type ZX Indicating Lamp illustrated below is listed and described on Pages 213-214 of Catalog #10.

Royal suggests the very pertinent Warner & Swasey ad (Time April 2) as required reading to the industry

ACTIVE BUSINESS MAKES JOBS

ROYAL ELECTRIC MFG. CO. 619 E. 40th Street CHICAGO 15, ILL.

Insto-gas

CUT SOLDERING COSTS up to 50%

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Please mail me your Insto-Gas Bulletin. Send me name of nearest distributor. (E.W.)

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The McGRAW

CENTRAL STATION DIRECTORY presents the latest, most accurate coverage of war-time changes in

ELECTRIC UTILITY operations and personnel

For intelligent, productive wartime and postwar planning or selling, the McGraw Central Station Directory should be in the hands of every executive responsible for such plans. Write for complete information.

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Subox

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CONTINUE AVAILABLE IN GOOD QUALITY AND FOR REASONABLE DELIVERY

Subox, Inc.

NORTH ARLINGTON, N. J.

REA Allots $417,000; Approves Contracts

The Rural Electrification Administration recently approved loan allotments totaling $417,000 to ten rural cooperatives in eight states. These funds, which will be used mainly for the extension of electric service to farms located near existing lines, bring REA allottments to $523,328,351, of which $24,448,550 represents operations during the current fiscal year. No construction will be undertaken which does not meet with WPB approval.

Details of the allotments are as follows:

ILLINOIS—Monroe County Electric Cooperative, Inc., Waterloo, $30,000.

MAINE—Kingman Electric Co., Kingman, $10,000.

MINNESOTA—North Itasca Electric Cooperative, Inc., Bigfork, $100,000.

MISSOURI—North Central Missouri Electric Cooperative, Inc., Milan, $10,000.

OKLAHOMA—Central Rural Electric Cooperative, Stillwater, $25,000; Caddo Electric Cooperative, Binger, $20,000; People's Electric Cooperative, Ada, $13,000.

SOUTH DAKOTA — Turner - Hutchinson Electric Assn., Freeman, $114,000.

TEXAS—Cap Rock Electric Cooperative, Inc., Stanton, $25,000.

VIRGINIA—Southside Electric Cooperative, Crewe, $70,000.

Construction Contracts Approved

ARKANSAS—Petit Jean Electric Cooperative Corp., Clinton, contract to Harvill-Byrd Electric Co., Little Rock, Ark. 62 miles of line; labor only, $15,011; engineer, Southwest Electrical Engineers, Jonesboro, Ark.

MONTANA—Yellowstone Valley Electric Cooperative, Inc., Huntley, contract to D. M. Manning, Hysham, Mont., 18 miles of line; $16,976; engineer, State Water Conservation Board, Helena, Mont.

OHIO—Washington Electric Cooperative, Inc., Marietta, contract to D & W Construction Co., Columbus, O., 88 miles of line; $83,780; engineer, Ralph L. Woolpert Co., Dayton 2, O.

OREGON—Benton-Lincoln Electric Cooperative, Corvallis, contract to City Electric Co., Boise, Idaho, 49 miles of line; $56,053; engineer, T. C. Smith, c/o the Cooperative.

SOUTH CAROLINA—Electric Cooperative Refrigeration Co., York, contract to Reamer Industries, Columbia, S. C., construction of freezer and bulk storage plant; $24,940.

TEXAS—Guadalupe Valley Electric Cooperative, Inc., Cost, contract to Sisco Electric Co., Conroe, Texas, 70 miles of line; $49,825; engineer, Beavers-Lodal, San Antonio, Texas.

66-Kv. Line Gets Approval

Building of a 24-mile, 66-kv. transmission line between Millville, W. Va., and Double Tool Gate, Va., has been approved by the War Production Board and work will begin early this summer, according to W. M. Krise, manager of the Northern Virginia Power Co. Cost is estimated at $200,000.

The top surface of this stick is in *compression;* the bottom was in *tension,* and broke. Likewise in a heating element: as it is turned "on" and "off", it alternately stretches and shortens itself, and thus subjects the surface of the wire to a cycle of tension and compression. This buckling action tends to make the oxide coating of the wire flake off. The wire that lasts the longest, is the one that flakes off the least. Chromel holds its oxide skin tenaciously tight, and hence makes the most durable heating element. For satisfaction, specify Chromel, described fully in Catalog-M.

RESISTIVITY @ 68°F

	WIRE (C.M. Ft.)	RIBBON (Sq. M. Ft.)
Chromel-A	650 Ohms	510 Ohms
Chromel-C	675 Ohms	530 Ohms
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Copel	294 Ohms	231 Ohms

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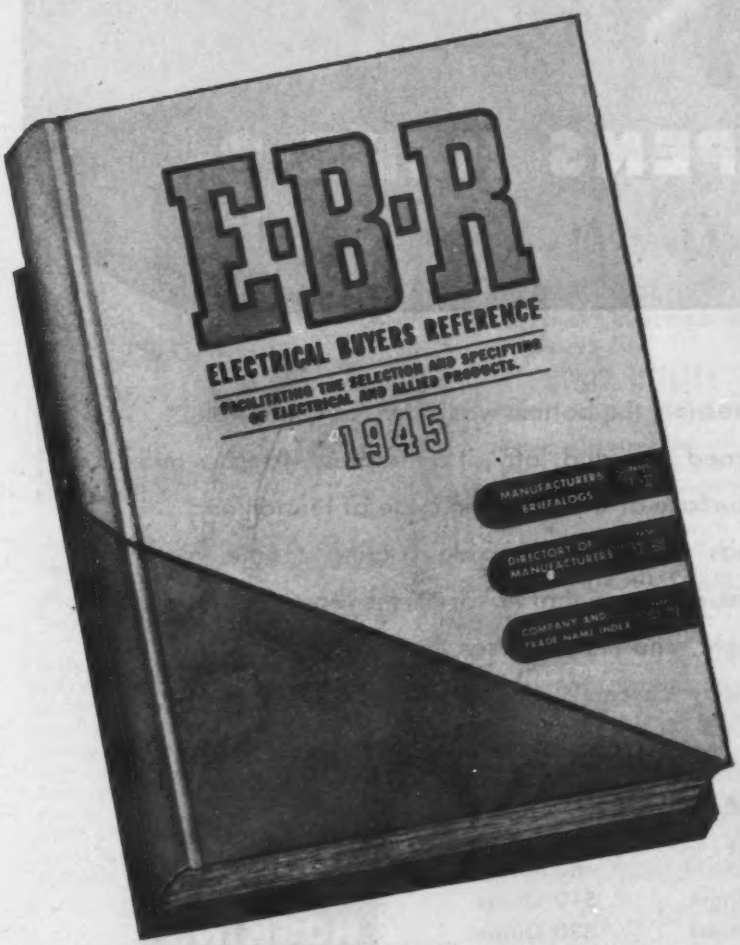
ELECTRICAL HEATING ELEMENT
WIRE

HOSKINS MANUFACTURING COMPANY, DETROIT 8, MICHIGAN

E-B-R ELECTRICAL BUYERS REFERENCE ...Your Efficient Servant



*Briefalog — E-B-R's own original version of modern condensed cataloging.

E-B-R is published for just one reason — to help you in your daily work of selecting the electrical products you need. It is the *only* reference published in, and for, the electrical industry.

It is not just a collection of manufacturers catalogs — or Briefalogs* — bound together. It is not just a directory of electrical products and their manufacturers. It is not just an index of trade names, and company names and addresses. *It is all of these combined.* And here is the way to use it for maximum efficiency:

Do you know the name of the manufacturer whose product you want to order?

Then look *first* in the manufacturer's Briefalog Index, pages 4 to 6, or in the Company and Trade Name Index, pages 693 to 724.

Do you know what product you want, but not the name of the manufacturer?

Then look *first* in the Directory of Manufacturers which starts on page 535. You will find all known manufacturers listed under the product heading. (Note that all products are indexed under the noun or principal word.)

When you locate the correct group of manufacturers, always refer next to the product data of those with boldfaced listings — and you will promptly get further buying data.

Do you know the trade name, but not the Company name?

Then look *first* in the Company and Trade Name Index, starting on page 693.

If you do not find what you want, write us and we will try to send you the desired information.

Every effort is made to have E-B-R complete and up-to-date at the time it goes to press. Naturally, in the year that passes between one issue and another, new products are announced, new manufacturers enter the field, old manufacturers bring out new lines. All this is entered in our files, so we probably can find exactly the data you want. This is a service we are glad to render.

YOU CAN BE A BIG HELP TO US, TOO.

If you see ways in which E-B-R can be made still more useful to you, please write us your suggestions. We will welcome them.

If you have any thoughts on ways in which certain manufacturers could improve the presentation of their catalog data, tell us that too — and we will try to improve their copy in the next edition.

In short, help us to help you.

Look it up FIRST in 1945 E·B·R

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- 150,000 C. P. SEARCHLIGHT BEAM
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DANGER!

DON'T PULL FUSES
WITH BARE HANDS

It may result in serious shock, burn, infection and even death

Use a TRICO

FUSE PULLER

Every electrician should carry one—hang one at every switchboard—put one in each tool kit—place one in every fuse box.

Order from your Jobber today—or write

TRICO FUSE MFG. CO., Milwaukee, Wis.
In Canada: IRVING SMITH LIMITED, Montreal

Recent Legislation

ILLINOIS—H.B. 416 provides that in cities with a population of 100,000 or more no purchaser of electricity or gas shall resell the same except at the prices fixed by law for a like sale by a public utility corporation and such sale shall be checked through a meter. The bill requires that such meter be readily accessible for inspection, authorizes such cities to employ inspectors for the enforcement of this act and requires the payment of an annual license inspection fee.

MAINE—Legislation, exempting rural electrification cooperatives from the supervision of the state Public Utilities Commission, was killed by the House.

NEBRASKA—A bill to give employees of public power districts the same bargaining rights "as may be made in privately owned public utilities" has been deferred by the Legislature's Labor Committee.

NEW YORK—Governor Dewey has approved the Stephens Bill as chapter 479 laws of 1945, amending section 20-b General City Law to continue to January 1, 1946, provision authorizing cities to impose tax of not to exceed one percent on gross income or gross operating income of corporations and persons furnishing utility services.

CANADA—A bill in the Nova Scotia Assembly which would empower the City of Halifax to acquire by purchase or expropriation all or part of the properties of the Nova Scotia Light & Power Co. has been set aside for six months, to enable the city to submit necessary information about its proposed action to the Legislature, and to obtain the approval of taxpayers of Halifax and of suburban communities. By a vote of 50 to 34, the Legislative Assembly gave third reading to Premier Maurice L. Duplessis' bill providing for the setting up of a system of rural cooperatives.

•

Recent Rates Changes

TELLURIDE POWER CO., serving south central Utah, has announced a reduction of 7.8 percent in rates to commercial and small industrial power users. Donald Hacking, chairman of the state Public Service Commission, stated the reduction would amount to $17,500 a year figured on the basis of the 1944 gross of $488,000.

CENTRAL MAINE POWER CO. has filed with the state Public Utilities Commission rate revisions effecting an estimated saving of approximately $300,000 to domestic users. Rates under the new schedule will be seven cents per kilowatt-hour for the first 25 kw.-hr.; five cents per kilowatt-hour for the next 40 kw.-hr.; and two cents for all over 65. Present rates are eight cents per kilowatt-hour for the first 25 kw.-hr.: five cents per kilowatt-hour for the next 50 and two cents for all over 70 kw.-hr.

BIRMINGHAM ELECTRIC CO. has made a reduction in commercial rates which is estimated to save customers approximately $100,000 a year.

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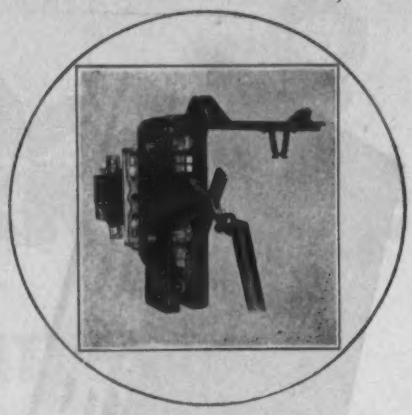
2 Small Municipals Sold

Consumers Public Power District of Nebraska has bought the electric system of Minatare for $25,000 and that of Riverdale for $3,500.



400 Ampere, Catalog 475

Compact

A New Jersey engineer had the fallacious idea that he couldn't get eighteen 400 ampere disconnecting switches in an available space of 21 feet.

Then he learned that Matthews Disconnecting Switches were only 3⅞ inches wide in the 200 and 400 ampere ratings and only 4¾ inches wide in the 600 ampere rating, and that they are all rated 7500 volts. His problem was solved and he had ample space to do a neat job.

This is their 16th year of successful service. Thousands are in use all over the country. Send for Bulletin.

Do you want to examine a sample? It will be sent prepaid on request, on loan account.

W. N. MATTHEWS
CORPORATION
ST. LOUIS, U. S. A.

600 Ampere, Catalog 675

1945 Edition of the McGRAW CENTRAL STATION DIRECTORY

NOW READY

This latest, most accurate coverage of wartime changes in electric utility operations and personnel is published for those who work in or sell to the electrical utility industry.

The 1945 edition of the McGraw Central Station Directory, now ready, lists in one compact volume every discoverable change in the electric utility industry during the past 12 months. Changes in personnel and operations up to April 1, 1945 and other exclusive data on organization, areas served, generation and distribution equipment are included for each of 4,000-odd utility plants in the U. S., Canada and U. S. possessions.

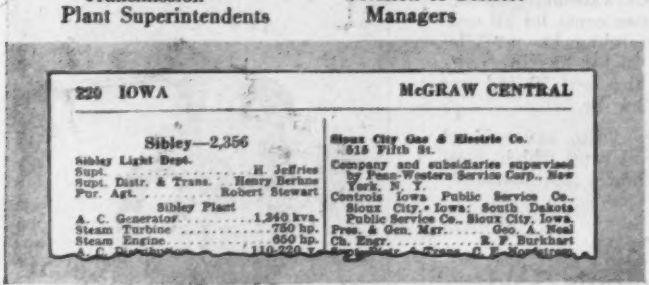
Facts Presented:

1. Names and addresses of private and municipally operated electric light and power companies in the U. S., Canada, and U. S. possessions; also government-controlled projects.

2. Names and addresses of affiliated, holding, controlling or managing and service companies with complete lists of properties controlled or managed by each, and including names and addresses of principal officials.

3. Names and addresses of officials and chief operating men for all operating companies, including:

- Presidents
- Vice Presidents
- General Managers
- Superintendents of Distribution
- Mechanical Engineers
- Commercial or New Business Managers
- Superintendents of Transmission
- Plant Superintendents
- General Superintendents
- Purchasing Agents
- Division or District Superintendents
- Chief Engineers
- Electrical Engineers
- Plant Engineers
- Merchandising Managers
- Division or District Managers



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Supt. Distr. & Trans. .... Henry Berbine
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Sibley Plant
A. C. Generator ..... 1,340 kva.
Steam Turbine ..... 750 hp.
Steam Engine ..... 650 hp.
A. C. Switchboard ..... 110-220 v.

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515 Fifth St.
Company and subsidiaries supervised by Penn-Western Service Corp., New York, N. Y.
Controls Iowa Public Service Co., Sioux City, Iowa; South Dakota Public Service Co., Sioux City, Iowa.
Pres. & Gen. Mgr. ..... Geo. A. Neal
Ch. Engr. ..... R. F. Burkhart
Engineer, Trans. & Dist. ..... C. F. Hawthorne

Sample page of Directory.

REA Co-ops Listed:

754 REA co-operatives have been listed separately in the back of the Directory. This list includes new co-operatives formed during the past year.

Use by Utilities:

The directory is used by hundreds of utility executives who wish to know about:

1. The organization of other utilities, especially those in their own or adjoining areas.
2. Movements of officials from company to company.
3. Discernible trends in expansions of operations of other utilities.

Use by Manufacturers:

Manufacturers of electrical generating, transmission and distribution equipment, and manufacturers of general equipment and supplies, all serving the vast utility industry, make constant use of the directory for

1. Names and addresses of executive, supervising, managing and engineering officials.
2. Determining electrical characteristics of plant, equipment and lines now in use.
3. Knowledge of scope of operations: generating capacity, towns and number of meters served, etc.
4. For each operating company, the following information is presented:

- Company total and plant individual generating capacity in kva. or kw.
- Kind of prime mover and capacity in hp.
- Amount of power purchased in kw hrs.
- Type of current distributed, No. of wires, phase, voltage and cycle.
- No. of meters served.
- Location of power plants.
- Complete list of towns (of 500 population or over) served.
- A complete alphabetical index of companies listed.

Edition Limited:

Strict rationing of paper quotas makes it necessary to limit the 1945 Edition. Orders will be filled in order of receipt. The Directory is sturdily bound in flexible blue Fabrikoid, fully thumb-indexed, size—4½" x 8½". Price $25.00 per copy. 10% discount on 5 or more copies. For intelligent, productive war time and postwar planning and selling, a copy of the 1945 edition of the McGraw Central Station Directory should be in the hands of every executive responsible for such plans.

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CONTINUOUSLY ADJUSTABLE CARBON RHEOSTATS

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Stackpole regularly supplies Carbon Piles in practically any length pile and diameter required. Resistance ranges have been materially expanded and a greater degree of resistance variation may now be obtained in a pile of a given size. Careful engineering control of manufacture assures a high degree of uniformity on a quantity production basis. Write for bulletin giving complete data.

CARBON DISCS FOR OTHER APPLICATIONS

Other Stackpole types include carbon discs for electric brakes for trucks, speed governors—or wherever a little power must control a lot of power with utmost precision, smoothness, and dependability.

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BRUSHES - CONTACTS *(All carbon, graphite, metal, and composition types)* IRON CORES RARE METAL CONTACTS
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PACKING, PISTON, and SEAL RINGS POWER TUBE ANODES, etc.

How many occupations in this picture?

There are no tricks—no hidden faces. Just see how many ordinary, every-day occupations you can find. Count 'em before you check the answer in the tiny type below.*

Whatever the number, it's a pretty safe bet that *all* these occupations—and many more—are represented among the folks who own your local electric light and power company.

Housewives and farmers lead the stockholder lists of most such companies. But there are plenty of nurses and doctors, teachers and mechanics, secretaries and salesmen, too.

*The artist—who ought to know—says there are 56.

There are several million of these *direct* owners—and you may be among them.

Certainly you are included among the *indirect* owners, if you have a savings account or life insurance policy. When you make a deposit or pay a premium, the money isn't just stuffed in a strong-box and left there. It's put to work earning a profit for *you*—a profit called "interest."

Banks and insurance companies invest your money carefully. They put a large proportion of it into electric light and power securities—because these companies have proved their basic soundness over the years by dependable service and good *business* management.

So the electric industry is probably the most widely owned industry in America. Almost every American has a stake in it. *And what helps the industry helps you.*

167 ELECTRIC LIGHT AND POWER COMPANIES

SELF-SUPPORTING, TAX-PAYING BUSINESSES

*Names on request from this magazine.

★ NELSON EDDY IN "THE ELECTRIC HOUR," WITH ROBERT ARMBRUSTER'S ORCHESTRA. EVERY SUNDAY AFTERNOON, 4:30, EWT, CBS NETWORK.

How to get fun out of a fact—and vice versa

The advertisement shown here throws new light on the old myth that the electric business belongs to Wall Street.

It's a picture puzzle, but there's nothing puzzling about the point it makes—*that the real ownership of the electric industry goes right down into Main Street . . . to you and you and you!*

This advertisement appears in national magazines during April. It is part of a public information program, now in its fourth year, which has aroused wide interest and enlisted more and more *business*-managed electric companies.

Similar advertising in magazines, farm publications and newspapers is backed by the powerful force of radio—"The Electric Hour" featuring Nelson Eddy — every Sunday afternoon, 4:30, EWT, over CBS.

Tune in this program regularly, read the advertisements as they appear, and tell your friends about them. *What helps your industry helps you.*

167 ELECTRIC LIGHT AND POWER COMPANIES

SELF-SUPPORTING, TAX-PAYING BUSINESSES

★ *Names on request from this magazine.*

"Certainly we're ready to talk elevators"...

DURING the past several years, the manufacturing facilities of the Otis Elevator Company have been devoted largely to the production of a great volume of specially designed elevators and precision equipment for a number of vital war requirements.

And, as long as the war lasts, a large part of these facilities will continue to be devoted to the production of war goods.

Right now, however, the Otis Elevator Company is in a position to help you *plan for your post-war elevator needs.*

Your Otis representative is ready to serve you. He is available to analyze fully your elevator problems and to make recommendations concerning the equipment which will be best suited to your post-war requirements.

By planning now, you will be assured that a minimum of time will be lost in getting your required equipment in production after war restrictions have been removed.

So, to be certain of the last word in vertical transportation for present or proposed office buildings . . . for hospitals, hotels, factories, or warehouses, call your Otis representative *today.*

Otis ELEVATOR COMPANY
OFFICES IN ALL PRINCIPAL CITIES

IT'S UP TO YOU TO HELP MAKE 2=3 WITH...

A job for seasoned executives—this 7th War Loan! Especially when we've got to make 2 war loans total just about as much as all 3 in 1944! Putting this over demands the combined and *continued* efforts of the "No. 1" men of American industry.

This means marshaling your plant drive to make every payday—from now 'til June 30th—do its share toward the success of the 7th. Directing the drive is not enough. It's equally important to check to see that your directions are being carried out—intelligently!

For example, has every employee had:

1. an opportunity to see the new Treasury film, "Mr. and Mrs. America"?
2. a copy of "How To Get There," the new Finance Division booklet?
3. a new bond-holding envelope with explanation of its convenience?
4. 7th War Loan posters prominently displayed in his or her department?
5. information on the department quota—and an urgent personal solicitation to do his or her share?

Remember, meeting—and beating—your highest-yet 7th War Loan quota is a task calling for "No. 1" executive ability. Your full cooperation is needed to make a fine showing in the 7th! Do not hesitate to ask your local War Finance Chairman for any desired aid. It will be gladly and promptly given.

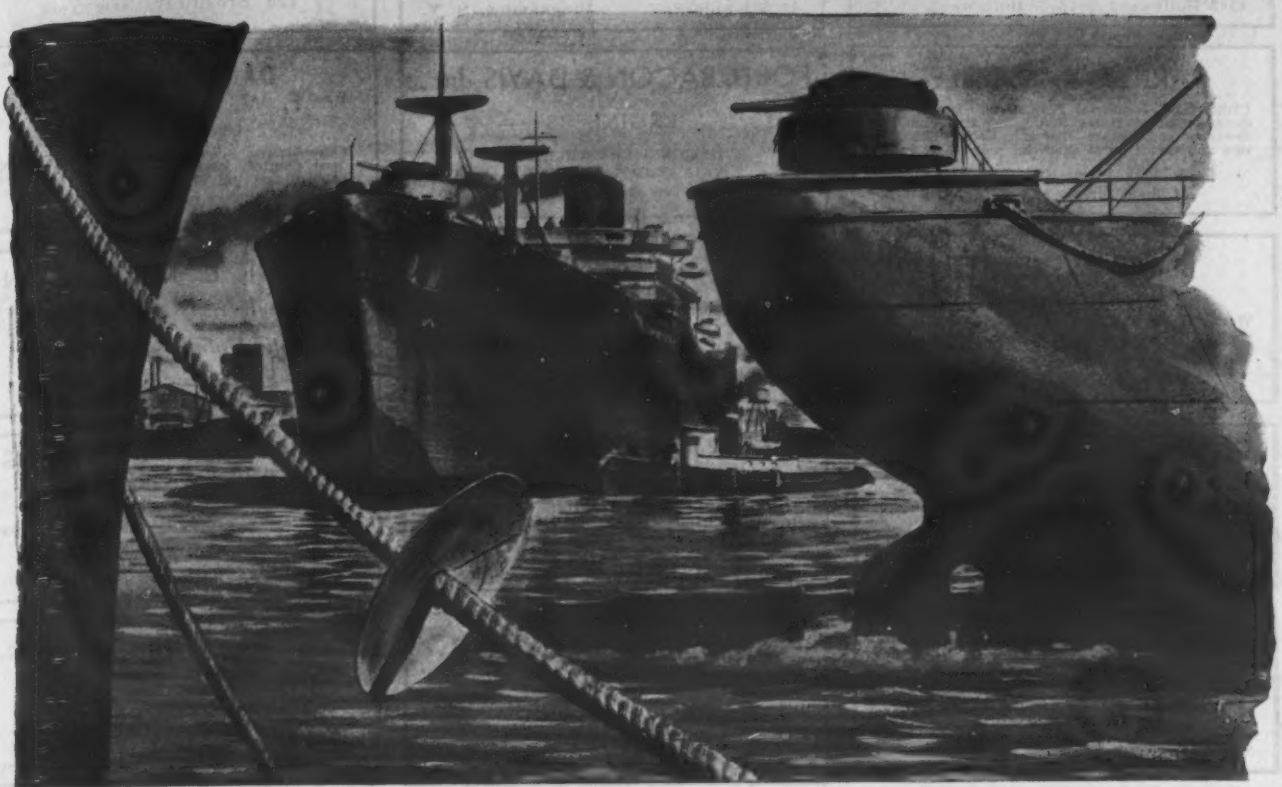
If you haven't a copy of this important booklet, "7th War Loan Company Quotas," get in touch immediately with your local War Finance Chairman.

The Treasury Department acknowledges with appreciation the publication of this message by

ELECTRICAL WORLD

★ *This is an official U. S. Treasury advertisement prepared under the auspices of Treasury Department and War Advertising Council* ★

Commercial Iron Works 'know how' delivers the goods of WAR...



...and the goods of Peace!

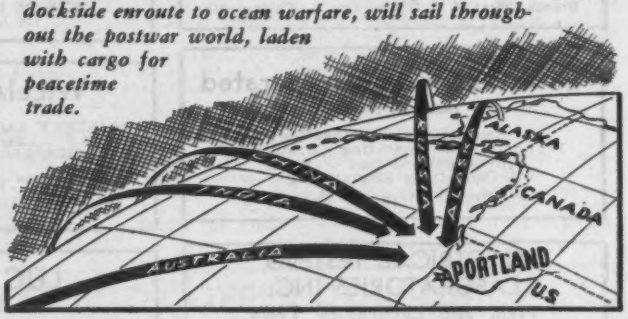
For two decades before the war, countless ships put in at Commercial Iron Works for a thousand and one repairs. Since the war, well over 175 ships built and equipped at Commercial Iron Works have landed at ports and on beachheads around the globe—many under heavy enemy fire—carrying precious fighting cargoes

CIW enjoys a well deserved reputation for engineering and construction, based on such achievements as the design and manufacture of gate machinery for ship locks at Bonneville and other Pacific Coast dams; heavy bridge operating machinery; and many types of heavy handling equipment, logging and mill machinery.

Whether it's ships for the world's greatest navy... or peacetime equipment for the world's greatest nation... Commercial Iron Works *know how*... delivers the goods!

PREPARED FOR GLOBAL WAR... AND GLOBAL PEACE!

Commercial Iron Works is strategically located to serve by rail, truck and water the Pacific Northwest's vast inland empire, as well as the incalculable postwar markets of South America, Alaska and the Far East. Ships now leaving CIW dockside enroute to ocean warfare, will sail throughout the postwar world, laden with cargo for peacetime trade.



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General Hydraulic Engineering, including the design, financing, construction and management of hydro-electric power plants.

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165 Maiden Lane New York

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for the
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Chicago New York San Francisco

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Electrical Insulation Engineers

Field Testing and Maintenance of High Tension Insulation, Special Problems in Electrical Communications.

Office and Laboratory: Medford Hillside, Boston, Mass.

Branch Office: 20 N. Wacker Dr. Chicago, Ill.

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But this oil is a compromise. Standard Oil chemists wanted a better solution. They wanted to use a highly refined oil and eliminate all asphaltene deposits. It could be done by adding an oxidation inhibitor to take the place of the natural ones. The hitch here was finding that inhibitor.

Standard Oil developed such an inhibitor. It was added to a highly refined white oil, the process was patented, and the product was called Nonpareil Turbine Oil. That's why Nonpareil is the only turbine oil that is completely free from asphaltene-forming hydrocarbons, with a *guarantee in writing* that it will not increase in acidity above the low neutralization number of 0.15 mg. KOH/gm. for the life of your turbine.

A Standard Oil Lubrication Engineer can tell you what this freedom from deposits and acidity formation means in lower maintenance costs and greater safety of operation. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, for the Engineer nearest you.

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